

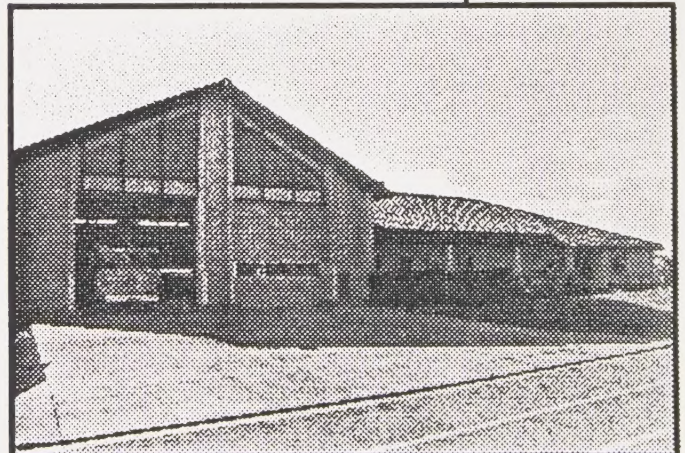
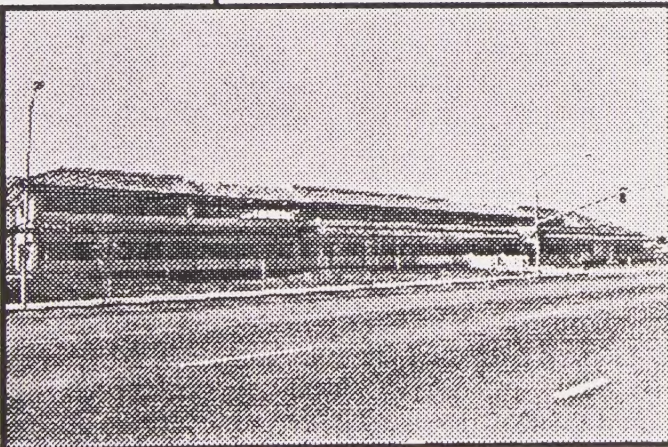
# City of Milpitas

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## Master Telecommunications Plan



November, 1995





# *City of Milpitas*

## **MASTER TELECOMMUNICATIONS PLAN**

Prepared by:

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Office of the Secretary

MASTER LIST OF VOTERS

1990 Census  
U.S. Department of Commerce  
Bureau of Economic Analysis  
Washington, D.C. 20540

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## EXECUTIVE SUMMARY

Pursuant to its Master Telecommunications Policy, adopted by Resolution No. 6353, September 6, 1994, the City of Milpitas, California, retained the consulting firm of Media Connections Group to help it develop a Master Telecommunications Plan. The plan is composed of two parts: an internal plan covering the City's telephones, computers and video equipment; and an external plan covering the development of a fiber network to connect all major city facilities.

### *The Internal Plan*

In order to develop the internal recommendations, MCG interviewed over thirty City employees and managers to determine work flow in and among the City's departments and divisions. The City staff and MCG, with the help of the City's Telecommunications Advisory Commission, surveyed the general public and the business community in Milpitas to ascertain the telecommunications needs of the community as they relate to interaction with the City government. The general public survey revealed that there is a high penetration of home computers in Milpitas and that, overall, there is a willingness to use advanced telecommunication methods to interact with the City on routine matters. Acceptable methods include computer bulletin boards, an Internet home page, fax machines and automatic response units. Similarly, the business survey revealed that almost all businesses have computers which can be used in self-inspection procedures, automated licensing procedures, etc. There is a willingness on the part of the business community to use advanced telecommunication services to conduct business with the City.

The employee interviews revealed that the City can improve productivity and job satisfaction by installing a City-wide local area computer network to connect the personal computers used by most employees and to interconnect existing LAN's that have been established on an ad hoc basis by some City departments to perform specific functions. In conjunction therewith, it is recommended that the City migrate to a PC-based platform from the existing mixed platform of PC and Macintosh machines. It is also recommended that the City implement groupware applications to improve efficiency in several areas and to create a uniform "look and feel" throughout the City's computer systems.

After a review of the City's phone records and consultations with PacBell and outside vendors, it was determined that the City could save money and significantly increase the functionality of its phone system by changing from Centrex service to a private phone system. The private system will be controlled by two PBX's located at strategic locations in the City and connected by fiber to form a "virtual building" for telephone and computer purposes. Each PBX will be capable of handling most of the City's voice traffic should the other one fail for any reason.

It was also determined that the City should move its management information functions in-house by creating an MIS unit composed of two people. The first person will be an MIS director who will be involved in high level planning and will administer and supervise the contract between



the City and the company which operates the City's mini-computer systems. The second person will be a network administrator who will be responsible for the operation of the computer network and will also supervise moves, adds and changes on the telephone system.

### *The External Plan*

After reviewing three possible network paradigms, including the construction and operation of a full service network, it was determined that the City should install a series of fiber rings in a phased approach for the purpose of interconnecting all major City facilities. The City's internal voice, data and video information will be carried on this network, thus fixing the transmission costs for these services and making the City independent of both the local cable system and the local telephone company. The ring design will insure that the network will continue to operate if the fiber cable is cut by accident at any one point along its route. Moreover, because backup power will be provided at the two key fiber hubs on the network, the bulk of the network's voice traffic will continue to move even if the City suffers a catastrophic power failure.

The five phases of the network project are timed to take advantage of scheduled public works projects which will be used to install telecommunications conduit inexpensively. By using existing conduit (most of which has been installed to carry traffic control cable) and by installing new conduit when public works projects open the streets for other reasons, the City can install the entire network at an extremely reasonable cost over an estimated five year period.

At the end of the project, the City will achieve route, vendor and switch diversity from the public telephone network and the local cable operator. Its internal communications will thus move even when the public telephone network is down and conversely, by virtue of "backup" phones run through the PBX's, its essential voice communications will continue to move even if the City's private network suffers a catastrophic failure. Constructing its own network will also fix the City's internal network costs for the foreseeable future.

### *Control of Rights of Way*

The Master Plan recommends that the City exert greater control over its rights of way to rationalize the impact of repeated street excavations by competing telecommunication companies. It is recommended that the City impose a moratorium after each major street is cut. It is also recommended that the City determine the present value of the damage done by each street opening and assess that cost to the applicant for a permit. Finally, it is recommended that the City recover the costs of City resources expended to supervise, inspect and control street excavations.

## I. INTRODUCTION

On September 6, 1994, the City of Milpitas adopted a formal Telecommunications Policy in Resolution No. 6353. The resolution is attached hereto as Exhibit A. In furtherance of the Policy, the City hired Media Connections Group ("MCG") to study the City's needs and recommend a Master Telecommunications Plan.

This document presents the recommendations of MCG to the City for the structure of a Master Telecommunications Plan governing all aspects of the City's telecommunication activities. The plan contains policies and strategies for human resources, new infrastructure development and upgrades to existing telephone and computer systems.

This report begins with a review of the scope of the project as defined in the contract between MCG and the City. It then describes the procedures followed by MCG and the City's staff to gather information on the City's telecommunications resources and its needs. The next section summarizes the contributions of the City's staff members who provided the basic information on which the plan is based.

As part of the plan, the staff and MCG conducted surveys of the businesses in Milpitas and the general public. The purpose of these surveys was to gather information on how the City could better interact with its citizens -- be they corporate or individual. The report discusses the surveys and presents an analysis of the information collected.

Next, the report reviews the existing competitive market for telephone services by reviewing the activities of the competitive access providers (CAP's) in the Bay Area. As this report is being prepared, California is in the initial stages of opening the local telephone market to competition and a number of companies, many of them CAP's, have filed applications to become co-carriers. However, competition in the local loop does not yet exist. Similarly, Pacific Bell has announced its intention to enter the cable television market in the state, but it has not done so. Thus, as of this writing, true competition in the telephone marketplace only exists in the competitive access market. In the video marketplace, true competition exists between DirecTV and Primestar, the nation's first direct broadcast satellite ("DBS") operators, and the local cable company. However, the penetration of DBS services is still very small and the cable company is, by far, the dominant video service provider.

After reviewing the state of competition, the report presents an analysis of the City's logical approaches to distributing its voice, data and video traffic over the next ten years. Three network paradigms are studied and an approach is recommended.

The final portion of this report makes specific recommendations on the following: (1) upgrading the existing telephone system; (2) establishing a local area network to link the personal computers used by the City; (3) creating a Management Information Systems (MIS) Department to



oversee the City's telecommunication activities; (4) constructing a fiber ring around the City to carry municipal information; and (5) taking greater control over the City's rights of way both to protect the City's network and to rationalize the existing practice by which each private telecommunications company insists on placing its own conduit and fiber cable under the City's major roadways.

## II. SCOPE OF THE PROJECT

By action of the City Council on November 1, 1994, Media Connections Group ("MCG") was retained as a consultant to the City to develop a Telecommunications Master Plan (hereinafter "TMP" or "Master Plan"). The City determined that it would develop a Master Plan when it became clear that: (1) the traditional lines of business provided by the local Bell operating company (PacBell), on the one hand, and the local cable television company (South Bay CableVision), on the other, were becoming blurred and, thus, the relationships between the City and these companies would need to be re-examined; (2) competitive access providers like Metropolitan Fiber Systems and Teleport Communications Group wanted to use the City's rights of way to provide "bypass" type telephone services to large businesses in the City; and (3) it was unclear whether the City's traditional powers over its rights of way might be restricted by federal legislation. It was felt that a strategic plan should be formulated to guide the ways in which companies, engaged in services which were not regulated by the California Public Utilities Commission, interacted with the City, both physically (use of the rights of way) and economically (franchise fees).

The exact scope of MCG's work was defined in Exhibit A to the Agreement for Consulting Services executed between MCG and the City:

Media Connections Group proposes to: (1) assist the City of Milpitas in the preparation of a plan (the "Internal Plan") to determine its internal telecommunications needs as they exist today and will exist through the next decade; and (2) assist the City in assessing the external telecommunication needs of the community (the "External Plan"). These efforts are essential preliminary steps in the development of a Master Plan that will be used to rationalize the use of the City's rights of way and its physical facilities by telephone companies, cable companies, competitive access companies and other companies seeking to provide telecommunications services within the City.

An outline of the steps to be taken to develop the plan are attached hereto as Exhibit B. The proposed time line for development of the plan is attached hereto as Exhibit C.

The plan was developed within the proposed time line and within the prescribed budget.

### III. PROCEDURES

MCG and members of the City staff responsible for the construction of the Master Plan, developed steps to be taken with regard to the internal review and the external review. These steps are summarized below.

#### The Internal Review

##### *a. Existing Uses of Telecommunications Networks and Equipment*

A physical inspection was made of virtually all City facilities from City Hall to sewer pumping stations. An inventory of telecommunications equipment was taken to determine the nature and extent of information flow to and from each location. MCG determined the types of connectivity used at each location and between locations.

In order to provide a comprehensive review of existing work flow patterns within the City, liaisons in each department were appointed to assist in the ascertainment of the telecommunication needs of each department. In addition, MCG principals personally interviewed over thirty members of the City's staff, including department heads, senior supervisors and key staff persons. A summary of the interview notes, presented by department, appears in Section IV, *infra*.

MCG participated in meetings with City staff members to discuss the implementation of new software systems, the purchase of computer hardware and the hiring of a director of information services. MCG focused on the potential integration of equipment and software with other systems likely to be established by the City and its departments after the Master Plan was finalized.

##### *b. Future Uses of Telecommunications Networks and Equipment*

MCG presented a formal overview of the evolving telecommunications markets to the department heads and some senior staff members. The "convergence" of voice, data and video networks was examined by focusing on the business plans of regulated telephone companies, cable television companies, competitive access providers, direct broadcast satellite ("DBS") companies and others.

As part of the interview process, each participant was asked to project changes in work patterns and information flow in their department over the next several years.

MCG and members of the City staff met with telephone vendors, computer network consultants and a groupware development company to discuss the ways in which the City could improve its telephone and computer systems.

MCG met with various departments that were in the process of implementing



telecommunications plans to assist them with their specific projects and to integrate existing projects into the developing Master Plan whenever possible. For instance, MCG met with representatives of the Fire Department to discuss a plan to disseminate training video via microwave. After discussions, it was decided to approach South Bay Cablevision and ask the system to use its fiber optic network to transmit the video to the other fire stations in lieu of the microwave system.<sup>1</sup>

The assessment of internal needs has already been used by the City's staff in other ways too. The City staff and MCG used the information to negotiate favorable terms with a wireless data company that will use some City light poles as supporting structures for its low-power data transmitters and receivers. In lieu of rent, the City received free service contracts and free wireless modems which can be used by City employees when they need to receive data while working in the field.

MCG also met with equipment vendors specializing in fiber optic terminal equipment to discuss the rapidly developing market for multi-function optic transmitting and receiving equipment. Several vendors made presentations on the design, functionality, cost and availability of their optical equipment. The intent was to determine if voice, data and video could be carried over fiber optic cable between major City sites in a cost-effective manner using City-owned equipment.

In a corollary investigation, focused on the realistic possibility of installing the fiber optic cable itself, MCG worked with the Public Works Department to investigate the potential use of existing conduits owned or controlled by the City (and used for traffic signal control) to carry fiber optic cable. In addition, the staff and MCG discussed the potential for installing new telecommunications conduit in scheduled public works projects involving street openings for other purposes (repair, laying sewer or water pipe, etc.). Finally, the staff and MCG focused on the ability of the City to install conduit in those public works projects that crossed major bottlenecks or physical barriers that would make it difficult for private parties to effect the crossing. In one existing project, the engineering department redesigned a bridge (crossing an interstate highway) to include telecommunications conduit in the span.

Ultimately, it was determined that a fiber ring could be built around the City, over a period of time, by taking advantage of existing conduit and street openings that were going to be done for other purposes. This approach was determined to be superior to microwave, coaxial cable and twisted copper pair.

### The External Review

Pursuant to the defined scope of work, MCG undertook to survey the telecommunications needs of the business community in Milpitas. A similar effort was made to survey the needs of the

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<sup>1</sup>South Bay CableVision indicated that it would use its network to distribute training videos for the Fire Department. Fire Station No. 4 is not yet served by the cable system and microwave may be used to reach the station if the cable system does not extend its lines to the station in the near future.

general public. In light of the joint project to install recycled water distribution pipes throughout the area, MCG and the City staff met with representatives from the cities of San Jose and Santa Clara to discuss the possibility of interconnecting the principal government facilities of the three jurisdictions using fiber optic cable. Finally, MCG and the City staff met with representatives of the Milpitas Unified School District to discuss the school district's telecommunication's plans and to determine if the efforts of the City and the MUSD could be coordinated.

*a. The Business Survey*

Working with the Telecommunications Commission, MCG developed a questionnaire designed to elicit information on the existing and future telecommunications needs of businesses in Milpitas.<sup>2</sup> The survey focused on the interaction of businesses with the City. A copy of the questionnaire is attached hereto as Exhibit E. The City mailed the questionnaire to over 400 local businesses. Almost 100 businesses responded, providing a representative sample for evaluation.

A detailed analysis of the responses is set forth in Section V, *infra*. In summary, it was found that almost all businesses had access to a computer with a modem and that most businesses would use advanced telecommunications procedures, like E-Mail, computer bulletin boards and telephone automatic response units, to contact the City on matters of routine inquiry. It was also found, however, that those businesses that contacted City departments regularly enjoyed the personal contact and the quality of service presently provided by the staff.

*b. The Public Survey*

As in the case of the business survey, the public survey conducted by MCG and the City focused on the interaction of citizens and the City government. Broader issues, such as competitive telephone services, interactive video and high speed data transmission to the home, were not addressed. It was felt that the development of new telecommunication services like those would be market driven and defined. Therefore, it was decided to assess the telecommunications needs of the citizens in the context of their consumption of City services. A questionnaire was designed by MCG and reviewed and approved by the Telecommunications Commission to elicit information concerning present and future methods of contacting the City government by citizens applying for a building permit, or seeking to use a City park for a group picnic or party function. A copy of the questionnaire is attached hereto as Exhibit D.

The City placed copies of the questionnaire on public counters throughout the City and public responses were also solicited at the Fourth of July street fair at the Great Mall. Copies of the questionnaire were also distributed to persons taking classes from the Recreation and Community Services Department.

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<sup>2</sup> The survey was also reviewed by the City's Economic Development Committee.



### *c. Interconnection of City Facilities in the South Bay Area*

Representatives of the City staff and MCG met with representatives from San Jose and Santa Clara to discuss the possibility of installing telecommunications conduit as part of the "Golden Triangle" recycled water project. In order to comply with federal requirements concerning the volume of effluent discharged into San Francisco Bay, the sewage treatment facility run by the three cities must decrease the amount of water discharged into the Bay. To accomplish this, the three cities will construct a distribution pipeline to deliver treated, but not potable, water to large irrigation users and manufacturing concerns in the region. Since this water cannot be commingled with the potable water supply, new pipes must be laid in a federally-funded public works project which will extend across the three cities. The cities explored the idea of installing plastic conduit to carry fiber optic cable in the trenches opened for the recycled water project.

While all the cities seemed to agree that the concept of installing conduit was a good one, they could not reach agreement on a joint construction project. San Jose recently issued an RFP soliciting proposals to install conduit and, perhaps, fiber optic cable by private telecommunications companies during the construction phase. Milpitas has decided to lay its own conduit during the construction of the first phase of the recycled water distribution system through its jurisdiction. Santa Clara has not yet decided what they will do given various fiscal constraints and differing objectives. It is possible that some infrastructure will be laid by the other cities in later phases of the project.

### *d. Discussions with the MUSD*

The Milpitas Unified School District has developed a Technology Plan which includes a networking component. The vision expressed in the plan is to provide local area network and wide area network connections to each classroom in each school building. These networks will allow each school to connect with the other schools in the MUSD and to the district offices, the county offices and the outside world.

The City staff and MCG met with representatives of the MUSD and described the opportunities that exist to construct telecommunications infrastructure throughout the City using existing and future conduits. Most of the buildings operated by MUSD are passed, or will be passed by the City's conduit. Prior to the meeting, MUSD had been focusing solely upon the possible use of microwave to interconnect its buildings. As the result of the meeting, MUSD is considering the possibility of sharing some of the City's conduit to lay fiber optic cable, or sharing bandwidth on a City-owned fiber network.

### The Telecommunications Commission

Pursuant to its Telecommunications Policy, the City formed a Telecommunications Commission, composed of citizens (with a Council liaison). This Commission meets regularly and advises the City Council on telecommunications matters. All the members of the Commission have an interest in telecommunication matters and many have special expertise in telephony, radio,



computers, software, etc. As noted above, MCG and the City staff worked with the Commission in the development of the business survey and the public survey. In addition, a member of the Commission, who is a teacher, attended a meeting with the MUSD.

Once a draft of the Master Plan was done, the Commission was asked to review the draft and offer suggestions and comments. The input of the Commission is reflected in this document and MCG is grateful for the Commission's contributions. By a unanimous vote, the Commission adopted the plan, as amended, at a meeting held on October, 5, 1995.

## IV. OVERVIEW OF STAFF INTERVIEWS

MCG conducted a series of interviews with the department heads and with key employees of each department in December of 1994. The goal of the interview process was to develop information on the work flow patterns of each department which could be improved through a modern telecommunications infrastructure. In order not to direct the conversations, or limit the scope of the discussions, the interviewers focused on work tasks rather than telecommunications hardware or software. Thus, a good interview would involve a discussion of the usefulness of voice mail as a tool in a given job or department, rather than on the type of voice mail system the City should employ. Similarly, discussions were held on what information the public requested routinely from a department and the time it took to answer public inquiries, rather than on how to automate the process.

Particular attention was paid to repetitive work functions. If an employee located in Public Works reported that he or she receives written reports daily from an employee located in City Hall, the type of information, its source and the format of presentation were topics of discussion. The fact that the information might be sent by computer modem or an imaging system was not discussed unless it was brought up by the interviewee.

Set forth below are summaries of the information collected during the interviews. A complete summary of the interviews, organized by department, is attached as Exhibit F. It should be stressed that this discussion hardly exhausts the opportunities to integrate work functions and work flow with modern telecommunications equipment in each department. It is representative, however, of the issues each department should consider as it is presented with the opportunity to utilize new techniques to improve the quantity and quality of its work product.

Since these interviews were conducted, the City has reorganized some of its departments. However, because the interviews generally dealt with work *functions* as opposed to job descriptions or positions, the original notes have been followed and the comments collected during the interview process are presented as if no organizational changes have occurred.

**The comments in this section (IV.) are summaries of the opinions of the speakers and not necessarily MCG;** however, some comments were the basis for recommendations made later in this Master Plan. These comments were offered to MCG in December 1994. A summary of them was promptly passed to the City Manager who has already implemented some of the ideas. In order to abbreviate the original interview notes, repetitive comments were generally not included, although certain topics (such as voice mail and E-mail) came up many times.

### City Manager's Office

#### *a. City Clerk's Office*

The public often asks the Clerk's Office for copies of the council agendas and copies of the municipal code sections dealing with barking dogs, noise restrictions and parking RV's. This is

presently handled primarily by telephone.

It would be nice to be able to connect the City to the county computer when the ballots are counted following an election. The general media is slow to report City results, or may not report them at all.

*b. General Matters*

It would be helpful to be able to distribute information on leadership training programs, grant programs, etc., after hours. Presently, the public must call during normal business hours to get this kind of information. This can be difficult for working adults.

An electronic link with the California League of Cities would be useful because the City could take down just the information it needed. At present, the City orders information from CLC and gets a lot of unwanted material in the process.

It would be useful to be able to distribute some memo's electronically rather than by hard copy. The City mail process can take days at times and is not always 100% reliable. The City needs better voice mail, the present system can be very slow, and it needs E-Mail.

It would be nice to be able to work from home occasionally and, therefore, a way of connecting a home PC with the office PC would be very useful.

**Fire Department**

*a. The 911 System and Computer Assisted Dispatch System*

The Fire Department and Police Department are users of sophisticated telecommunications technology. The City's 911 service, the computer assisted dispatch system (used by both departments) and the Emergency Operations Center are state-of-the-art operations. While representatives of Fire and Police voiced the desire to improve these facilities further, by any measure, and certainly within the frame of reference created by the City's other departments, these systems are well designed and well operated. The master plan does not include the 911 and CADD systems within its scope of study and these comments are made simply to record the fact that these systems were not ignored during MCG's investigation of the other tasks performed by members of the Fire and Police Departments.

*b. Use of Personal Computers and Data Terminals*

The Fire Department is one of the most progressive departments in the City in its use of personal computers. The department makes its own street maps, for instance, using a standard Macintosh software program. It also has E-Mail and senior management has access to voice mail. Data circuits (over PacBell lines) transmit dispatch information to each fire house, where the



information is printed and is displayed on a large wall-mounted sign board.

It would be useful to connect the fire houses with sufficient bandwidth to permit remote training. At present, members of the department must come to the training facility (located at Fire House No. 1) which means the other stations are under-staffed during training sessions. Because training is routinely conducted, the staffing shifts have affected fire insurance premiums in the City. At MCG's suggestion, the department is presently working with South Bay CableVision to use the cable system to distribute training videos to the "outer" fire houses and it is possible that some accommodations will be in place before year's end.

It is possible that small businesses might be able to self-inspect if the appropriate software and computer connectivity to the City were available.

The fire trucks are not equipped with mobile computer terminals because it is felt that the investment is not warranted at present. However, MCT's might be useful if they could quickly display information on disabled persons (for EMS) and hazardous materials information in the case of a fire or other emergency.

There is a need to better coordinate the activities and the reports of the hazmat inspectors and the fire inspectors.

#### *c. The Emergency Operations Center*

In times of emergency, the EOC could use real-time video (perhaps provided by a fly-over) and, therefore, a means of moving video to the EOC would be desirable. Moreover, in times of emergency, it would be desirable to send information to the general public via Channel 6 on the cable system.

It would also be desirable to have remote training available in City Hall because emergency training sessions conducted in the EOC occur too infrequently due to their interference with normal work flow. Therefore, a means of moving video from the EOC would be useful for emergencies and for routine training.

### **Finance Department**

#### *a. Internal Customers*

The department could better service its internal customers if it could distribute documents, like financial reports, electronically rather than by paper. The budget process is presently done by computer and is an example of what needs to be done with the other finance software components.

Service of internal customers is hampered by the state of the main frame computer. Some functions are on the old Vax system and some are on the new, Oracle system. This is a matter of

negotiation with the service provider, BRC.

The purchasing department is hampered by the volume of paper involved in its job. It would be better to have a way of processing purchasing documents electronically. It would also be useful if purchasing could access equipment catalogs electronically so prices could be compared across vendors and items could be ordered electronically.

It would speed up internal processes if the department could tap into state and federal data bases electronically. This would be particularly useful in the preparation of financial statements.

In order to manage the City's investments, it would be nice if the department could electronically access information on stocks and bonds. The present method is too slow in today's fast moving markets.

The department presently uses the telephone and fax to do electronic funds transfer. It would be useful if this could be done by computer.

*b. External Customers*

Developers presently keep a deposit on file with the City which is drawn against for filing fees, etc. It would be better if the City could make an electronic debit against an outside account. This would avoid having to contact the developer when the deposit is low.

The same debit system could be used to issue business licenses. In fact, the licenses themselves could be issued electronically to businesses connected to the City by modem, etc.

**Economic Development**

It would be helpful to have a computer local area network in the City so that information could be shared easily. It would also be helpful if local businesses could access part of the network to obtain information from the department and from other City departments.

The department needs a quick way to send information on Milpitas as a business location and on the quality of life here to brokers and agents located out of town.

The City should use Smart Valley to promote the City and the region.

If City ordinances could be put on a CD-ROM, that would be helpful also.

The City does a Municipal Services Appraisal bi-annually. If all or part of the survey could be done on-line, it might make it easier to expand the scope of the appraisal. It might also speed up the process.

The City should put kiosks in the community so citizens can contact the City easily. Each kiosk should have a City phone directory in it to help the citizen contact the correct person. This process could start with the schools.

### Public Works

#### *a. Utility Division*

The division sends out 200 to 300 letters a month to commercial customers reminding them to test backflow valves as required by law. This could be better automated.

There is no major customer contact on a daily basis by the professional staff; however, the staff is part of the building permit process and gets public contact that way.

The staff makes manual entries of the Hetch Hetchy volumes and pressures every day. This process should be automated.

It would be useful to be able to pull up a map of water and sewer connections on a PC in case of an emergency. It sometimes takes 30 minutes to cut off the water after a break in the line because it takes that long to find the correct valve in the paper records.

#### *b. Solid Waste*

The City needs to improve the phone system. It would be helpful if the public could check on the status of a water and sewer bill without going through the staff.

The public often calls the City when a pickup is missed or is late. They are supposed to call BFI, the City's contractor, but many do not. If the department had E-Mail, it could be used to leave messages and receive messages from BFI.

In the future, the City may need special reports from business users of their solid waste disposal system. It would be helpful if this could be done electronically. The same is true of the school system.

Solid waste and the water divisions do not share a customer data base. It would be helpful if there was only one data base for the utilities. It would be particularly useful for creating mailing lists.

The department should make better use of Channel 6 on the cable system to put out information on recycling, special pick-ups, etc.



### *c. Water*

The department still does a lot of record keeping by hand. Many processes could be streamlined. For instance, the department collects a lot of information from people in the field on pressures and volumes. If this information could be collected automatically and sent to a central office, it would reduce a lot of field time by the staff.

The reservoirs need to be connected to a central office to collect telemetry and to send control signals to start and stop the pumps.

The Milpitas SCADA (System Control and Data Acquisition), which is used to control the water system, should be interconnected to the San Francisco and Santa Clara systems so information could be shared quickly and regularly. If this was done, it would be much easier to control the pressure in the system.

By November, 1997, the region must begin to deliver recycled water to user sites for irrigation, manufacturing, etc. This will involve laying a network of new water pipes throughout the San Jose, Santa Clara, Milpitas area.

### *d. Engineering*

The City should standardize on an IBM based PC system and get rid of the Macs. The application software for the IBM PC is much better, particularly for engineering tasks.

Public Works needs to track projects better than it does now. PW needs to be able to play "what if" games with the many capital projects that are open at any one time; it is very difficult to do that now. PW is working with Finance on a better system. Dedicated project management software is needed. Such software will also help fill the "peaks and valleys" that are inherent in project management.

Engineering is involved in the planning process and, while each department gets its own set of plans to review, the reviewing staff members generally communicate by sending written memo's or notes to each other.

The City should have centralized scheduling, so you can tell where someone is on a given day. This is particularly true when it comes to determining whether an inspector is available to visit a project.

The department is hopeful that the City will issue an RFP for a computer-aided drawing and design program (CADD). It is likely that AutoCad will be chosen because it will fit well with the files already on hand. It is also important that the CADD software is compatible with GIS (geographic information systems) software given the general movement in that direction. It would also permit the use of one set of base maps for police, fire, public works and planning because each department could build its own layer on top of the base map.

*e. General Administration*

Public Works uses its own dispatch system. The City could use one system to dispatch police, fire and public works.

The City must rebuild City Hall because of earthquake standards and the Americans With Disabilities Act. Access to portions of the building can be difficult for people protected by the ADA.

*f. Parks and Facilities*

The City needs to utilize the cable system to put out information to citizens.

Softball diamonds lights are turned on and off by users who get keys from the City. However, the tennis and basketball lights are on timers. It is possible to have the lights on and no one using the facility. It would be good if these lights could be turned on and off to accommodate actual use.

The department will monitor the use of water by the parks and median strip irrigation systems in the future. This needs to be done remotely. It would also be efficient if the irrigation systems could be controlled remotely. This would eliminate the need to send someone to turn the systems on and off and it would eliminate the use of timers.

Landscape water ordinance requires the City to approve irrigation systems for parcels of one acre or more. The engineering staff at City Hall processes the applications and the staff located at the Public Works building is involved as well. Soon the information will be sent by modem. This is not done at present.

**Staff and Administrative Services**

*a. Generally*

If the City decides to change from its present Centrex system, it must have a person in charge of the PBX system so that moves, adds and changes ("MAC's") are done correctly and on time. At present, MAC's are done by PacBell and there is no one in the City responsible for them.

The City should have its own MIS unit.

The City should issue ID cards to all employees with pictures on them. For those employees authorized to make purchases for the City from local businesses, the card should have a magnetic strip that would contain the authorization and the dollar limit given the employee. Presently, it is time consuming to send someone to a local merchant to purchase something the City needs.

The City should move to electronic keys. There are a lot of keys floating around now and it

would be easier to control authorization to remote sites like pumping stations if there was an electronic lock instead of a mechanical one. The employee's ID card could serve as a key as well.

*b. Vehicle Maintenance*

Service records are maintained on a PC, but better software could be used. Presently the department uses postcards to remind City employees to bring vehicles in for service. If they ignore postcard, they are called on the phone. E-Mail and/or voice mail would be helpful.

The City should use a leak alert system at all fuel locations. One tank had a slow leak and everyone thought it was going down solely because of usage. A leakage monitoring system would tell the staff if the level dropped between uses. The system would also save on testing levels by hand, which is the method used now.

The yard radio system is a problem. It is a simplex type which will not permit two people to speak at the same time. This leads to blockage.

*c. Word Processing*

There is a need to improve the way work comes into word processing. At present, word processing does a lot of work for the Police Department. Most of the work is delivered by hand twice a day on audio tape. If the written document needs to be reviewed, it is either hand carried or faxed to the PD. Edits are returned the same way. Connecting the PD and word processing electronically would be very useful, but the City would have to be certain that security was tight. Many of the documents contain sensitive information.

All official documents are stored in hard copy now. There may also be an electronic copy in word processing, but it is not official. Retention is a real issue and the City is presently using a consultant to establish a formal retention and document destruction program.

Producing the council agenda is hectic. Most department heads give word processing their items in hand written format. The draft item is produced and then edited by hand and returned for further drafting, or for final production. A lot of paper is walked or faxed around during this process.

Presently, word processing has only one phone extension. The four employees share this extension using four phones. This leads to confusion at times.

*d. Public Information*

The City should go to a full interactive video system. Video cameras could be mounted on PC's for video-phone service now. In the future, it will be very cost effective. This might be an excellent technology to use if the City puts kiosks in the community so that citizens can contact the City staff directly. With two-way video, the caller and the staff person could see each other.



The City needs to upgrade its video equipment substantially. The City is presently studying the possibility of forming a citizens organization to do video over Channel 6 on the cable system.

### Recreation and Community Services

#### *a. Internal Issues*

Library services will be taken over by a joint powers agreement among eight cities in the South Bay. The initial plan is to establish satellite libraries in a school in each quadrant of the City. There will be a need to share catalog information quickly between the satellites and the main library. There will also be a need to share catalog information among the eight cities.

HS is presently using scheduling software which was installed by its staff. Remote scheduling can be done by using PC Anywhere software.

It is difficult to communicate with the pools in the summertime. The only way to do it is by phone. In fact, HS cannot share registration information with remote sites, except by phone.

It would be useful if remote cameras could be used for security at HS facilities, like the Senior Center or the Sports Center.

#### *b. External Issues*

Customers can register for classes using a touch tone phone. About 10% of users do this, most at off-hours. Customers can also register by mail or in person at the Community Center. It is not possible to register at remote sites now. It would be helpful if this were possible.

The City should erect electronic bulletin boards at major traffic intersections. HS would use these to advise the public on upcoming events, classes, etc.

At present, HS cannot go to a user data base and print labels sorted by area of town, or by area of interest (swimming, aerobics, tennis, etc.). It would be very useful to be able to do this.

### City Attorney

The department has internal E-Mail, but it is not connected to the other departments and is of limited value because the department is so small. It would be helpful to have a City-wide E-Mail network, but if one is implemented, there would have to be guidelines on when a document placed in E-Mail became a public document.

The department continues to have difficulty with phone service. On too many occasions, it takes hours for staff members to retrieve messages from voice mail.

Most work comes into the office on a three-part form. People walk it in. It would be useful to be able to send documents around the City electronically. Security would have to be good, though.

Resolutions are reviewed by the office and are prepared in word processing. Review and edits are presently done by hand. It should be done electronically.

The CD ROM Lawdesk program gives the attorneys access to California statutes at their desk PC's and has proved valuable. It would be very helpful to extend this capability to home computers in order to facilitate after-hours and weekend work.

The office shares documents electronically with outside law firms at present. This is done by sending computer disks around. Files are not sent electronically.

The office wants a separate fax machine. The attorneys do not send fax's using their computers and fax software at present.

It would be nice if the office could file papers with the courts electronically. Everything is filed in hard copy today. Changes would need to be made in court rules before electronic filing would be possible.

### Police Department

Although there are complaints about certain functions of the computer aided dispatch (CAD) system, it handles 25,000 to 30,000 calls a year successfully. The CAD data base is kept on a BRC main frame computer located in the Public Works building. The front desk at the main station handles about 5,000 calls a month.

The department is experimenting with mobile computer terminals in some of the squad cars. One feature that would be useful is the ability to request information on a license plate without going through dispatch. If successful, the department may implement wider deployment of the technology.

It would be useful if training information on each officer could be kept in a data base that could be accessed by senior management. At present, managers must go through personnel and must examine a physical file.

The department runs a substation, which is manned part-time, at the Great Mall. It would be useful if the substation and the main station could be connected by two-way voice and video. This could be used for the exchange of information and for security.

The use of video at crime scenes is also desirable. It would be useful to videotape gang graffiti, physical crime scenes, etc. It would also be useful to use an imaging system to capture officers' field notes so they can be shared with other officers. This is difficult to do now.

The department would like to be able to distribute video directly to the public. An example might be a video on bicycle safety during the holiday season and summer months. There is a closet full of this kind of material which could be disseminated.

If small businesses were connected to the City by modem or computer network, it would be possible to distribute information on crime rapidly and easily. At present, beat officers do this, although it obviously takes time and is not comprehensive due to the press of more important duties.

Sharing data and information with the county can be tough. At present information going to the Elmwood Correctional Facility and to the courts moves by hand in paper form.

Sharing information with the sheriff is done by data lines. This is where state and federal information comes from. This is a high speed down stream service; upstream is slow. There is a county system which is used to send photographs between police departments. The system uses dedicated phone lines.

Electronic links between word processing in City Hall and the main station would be nice, but not if it means officers cannot record field information using cassette recorders. Recording field information is the most efficient way to produce thorough reports quickly. Also must make certain that the links are secure. Some information which passes between the PD and word processing is very sensitive.

### Community Development

Once an application is filed, planning sends copies of the plan to fire, engineering and building. The planning department types up a report and circulates it to the other departments and divisions. Each department keeps its own copy of the plan and comments by sending notes back and forth. Once everyone has commented, the representatives of the departments meet and discuss the plan. If approved, it is then sent to the Planning Commission for action. If this process could be done electronically, it would speed up the approval process and reduce the number of staff meetings. However, it is still likely that each department would want a paper copy of the actual planning document to review. Electronic copies (or images) probably would not be as easy to use.

The process for building permits is very similar to the process described above.

The staff reports generated in this process are often hand carried to word processing. This is very time consuming. The staff could produce their own reports if the appropriate software was available.

It would be helpful if the department had a way of sending E-Mail messages to the members of the Planning Commission (and vice versa). Voice mail works for some members of the department, but it can be slow and there is no light telling you if a message has come in.



Status inquiries on building permits and planning documents takes up a lot of staff time. It would be useful if this could be done automatically using tracking software. Computerizing planning and licensing will be a priority of department.

Land use planning is done using FoxBase Pro software. All use permits are computerized. About 40% of environmental studies are computerized at present.

It would be useful if the staff had access to laptop computers. This would allow people to work at home if the proper communications software was available.

## V. PUBLIC SURVEY

### *a. General Discussion*

Media Connections Group and the staff conducted a survey of the general public to determine the public's willingness to use advanced telecommunications methods to conduct business with the City. A copy of the survey form is attached hereto as Exhibit D.

Responses to the public survey forms were collected in three ways. First, the City ran a booth at the July Fourth Fair held at the Great Mall. Members of the public who stopped by the booth were given a copy of the survey form and asked to complete it. A copy of Netscape software (donated by the company) was given to each member of the public who completed a form.

Second, copies of the form were distributed to participants in various classes conducted by Recreation and Community Services. Finally, copies of the forms were placed on the counters at the Community Center and at City Hall. These methods generated 72 properly completed forms. While the sample size is considered sufficient for the purposes of the Master Plan, it must be remembered that the bulk of the forms were collected at the Fair and may be skewed toward computer users because of the availability of the Netscape software.

### *b. Demographics*

Figure 1 shows the basic demographic profile of the Milpitas public survey sample. The split by gender and by residence was within expected parameters. By age group, the sample was skewed toward adult responses, with a combined 81.9% of the sample covering the age range of 25 - 54. This is deemed acceptable for purposes of the instant study because most persons conducting business with the City will fall into the adult age category which dominates the sample.

While almost half of the sample indicated a residence other than Milpitas, a cross-sample comparison indicated no significant difference between residents and non-residents in such things as computer ownership, fax ownership, etc.

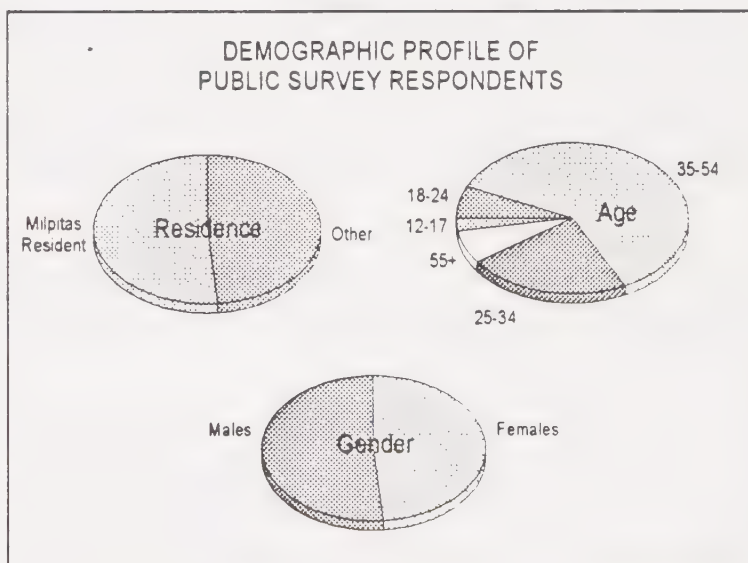


Figure 1

Almost half the sample (48.6%), indicated that they had a personal computer in their homes. This is a higher percentage than the estimated national penetration of home computers, which Chilton Research estimates to be 25% as of 1995.<sup>3</sup> However, Chilton found that 36% of 18 - 49 year olds used a PC in the home. Thus, it can be inferred that the Milpitas sample is skewed by age. The influence of the Silicon Valley environment surely contributes to the higher average as well.

In contrast, Chilton found that only 7% of the 18 - 49 year olds used a home fax machine. In the Milpitas sample, 41.7% indicated that they had access to a home fax. It is likely, however, that many households use their computers to fax documents using fax software and a modem. Thus, it cannot be inferred that 41.7% of the respondents maintained stand-alone fax machines.

### c. Willingness to use New Technologies

Figure 2 depicts the expressed willingness of the sample to use existing equipment to transact business with the City in ways other than physically visiting City offices or using the telephone to make a voice inquiry.

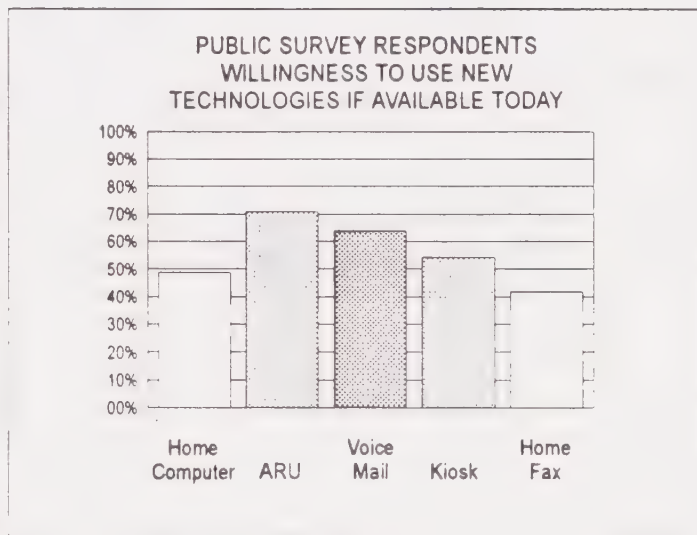


Figure 2

Almost half the respondents indicated that they would use their home computer and a modem to check on a pending matter with the City, if the service was available. Just over 70% said they would use an automatic voice response unit to run a status check. Over 69% said they would use voice mail if they had access to the City's voice mail system. Just over half indicated that they would use a kiosk and a computer to check on a matter of personal interest. Finally, more than 40% said they would use a home fax to file information with the City.

When asked if they would use these technologies in the future, thus removing the restraint of actually owning a computer or fax machine, the respondents indicated a greater willingness to test new technologies. Figure 3 on the next page graphically indicates the positive nature of the responses.

Almost 100% indicated that they would use a home computer to make status inquiries if they had one at home. Similarly, almost 100% indicated that they would use an automated voice response unit if it were available in the future. Approximately 80% indicated that they would be willing to use voice mail, a kiosk (and a computer), or a home fax to transact business with the City.

<sup>3</sup> USA Today recently estimated that home PC penetration was 36%, up from 31% in 1994; October 16, 1995, p. 1D.



These results bode well for the City and its staff. The employee interviews made clear that significant staff time is expended responding to inquiries from members of the business community and the general public on routine, pending matters. If procedures could be established which would provide useful, timely and easily accessible information, the general public sampled in this survey clearly would use modern techniques to access the information. Depending on the kind of information and its complexity, computer bulletin boards, ARU's, fax inquiries (and responses) and, perhaps, access to a portion of the City's voice or E-Mail systems might free up staff time, improve efficiency and provide better service to the City's customers.

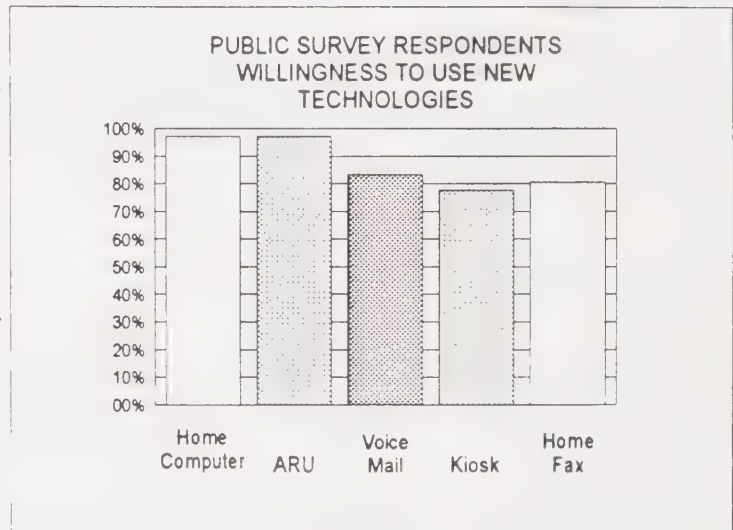


Figure 3

## VI. MILPITAS BUSINESS SURVEY

As part of the external needs assessment, surveys were mailed to 440 businesses located in Milpitas. The results reported herein are for 91 respondents, or approximately 20.7% of the surveys sent out by the City. Given the length of the survey (affixed hereto as Exhibit E), this response rate is considered excellent.

### Nature of Respondents

Figure 4 depicts the distribution of responding companies by number of employees. Of the 91 respondents, six (6.6%) were business with 250 or more employees, the largest size category in the survey. The next category contained ten respondents (11.0%) and covered businesses with 100 to 249 employees. The third category covered businesses with 26 to 99 employees. Thirty two responses were received in this group, representing 35.2% of the universe. Fifteen responses (16.5%) were received in the fourth group which included businesses with 11 to 25 employees. The fifth group included businesses with six to ten employees. Sixteen responses (17.6%) were received from this group. Finally, the smallest businesses (five employees or less) constituted 13.2% of the total group of respondents. Since these groups are small, statistical information by company size is offered for informational purposes only. No statistical validity should be attributed to these samples.

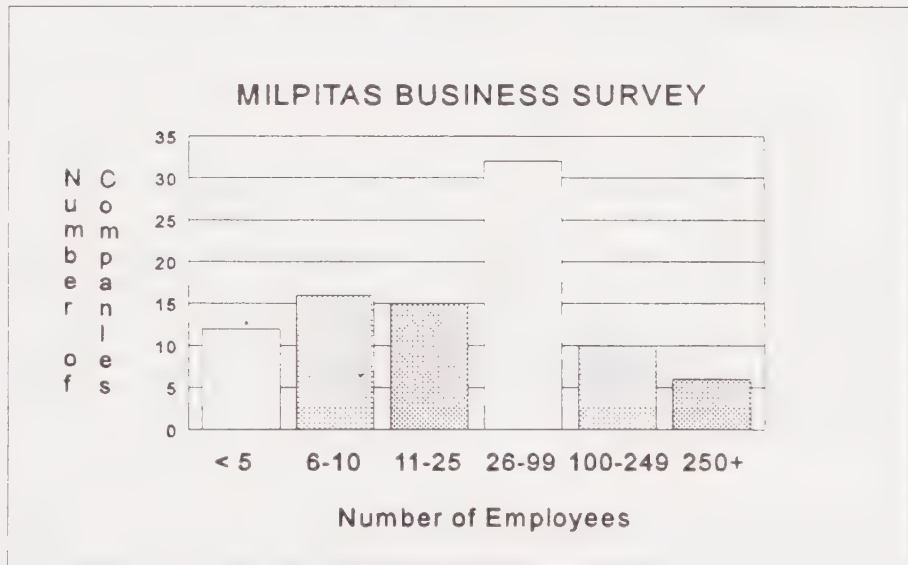


Figure 4

Figure 5 depicts the telecommunications facilities owned by the responding companies. Of the total businesses responding, 87.9% own their own phone systems instead of relying on the public switched network for normal business features like call forwarding, call waiting, etc. While the penetration of PBX's and key service units is not surprising, it is somewhat surprising to note that businesses reporting six to ten employees primarily own private phone systems (81.3%). Three quarters of the smallest businesses (five employees or less) owned their own phone system (75.0%).

Modem penetration was also high. 76.9% of the respondents owned a computer with a modem. The prevalence of "on-line" capable computers tracked into the smallest employment units. 56.3% of businesses reporting six to ten employees owned modems and 50.0% of businesses with five employees or less owned modems.

Internet use was significantly lower in all subgroups. For the group as a whole, 34.4% reported that their company used the Internet in the course of business. The extent of use followed company size very closely. Eighty percent of the largest companies access the internet while only 8.3% of the smallest companies have ventured onto the "net." The percentages fell with every decrease in size category.

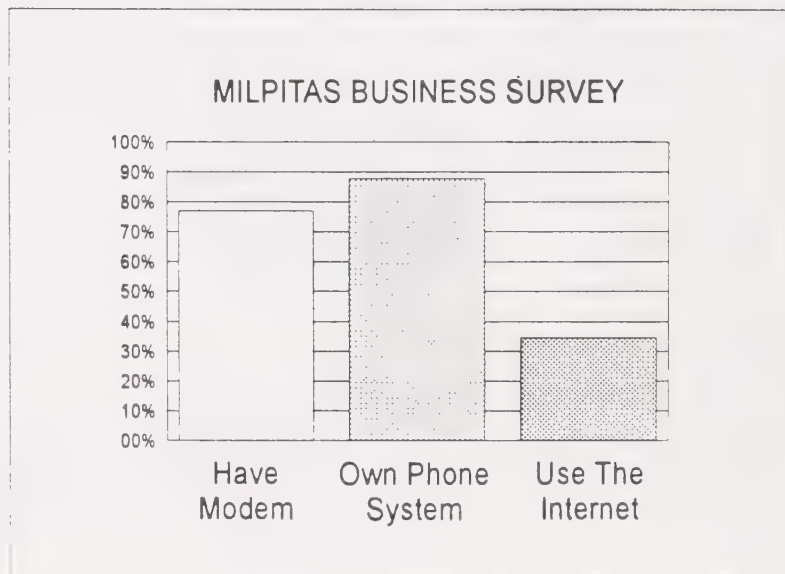


Figure 5

## Information on Municipal Contacts

### *a. Method of Contacts*

Set forth below is a table which summarizes the methods used by the respondents to contact City departments. As can be seen, the most common method of contact is the telephone, followed, in order of use, with personal visits, letters or postcards, fax, and other methods.

Method of Contact	All Departments	Community Development	Fire Department	Police Department	Public Works
Phone	69.8%	54.6%	61.1%	100.0%	100.0%
Visit	43.0%	59.1%	50.0%	23.1%	33.3%
Fax	3.5%	4.6%	5.6%	--	--
Letter	15.1%	13.6%	13.9%	--	50.0%
Other	1.2%	4.6%	--	--	--

Responses were given for Finance and Recreation and Community Services, but the samples



were too small to break out. It should be noted that the survey asked if the respondent used E-Mail to contact the City, but no respondents indicated that they used that method, even though the City recently joined the Virtual Valley computer bulletin board ("BBS").

Figure 6 shows a comparison of the contact methods by department in graphical form.

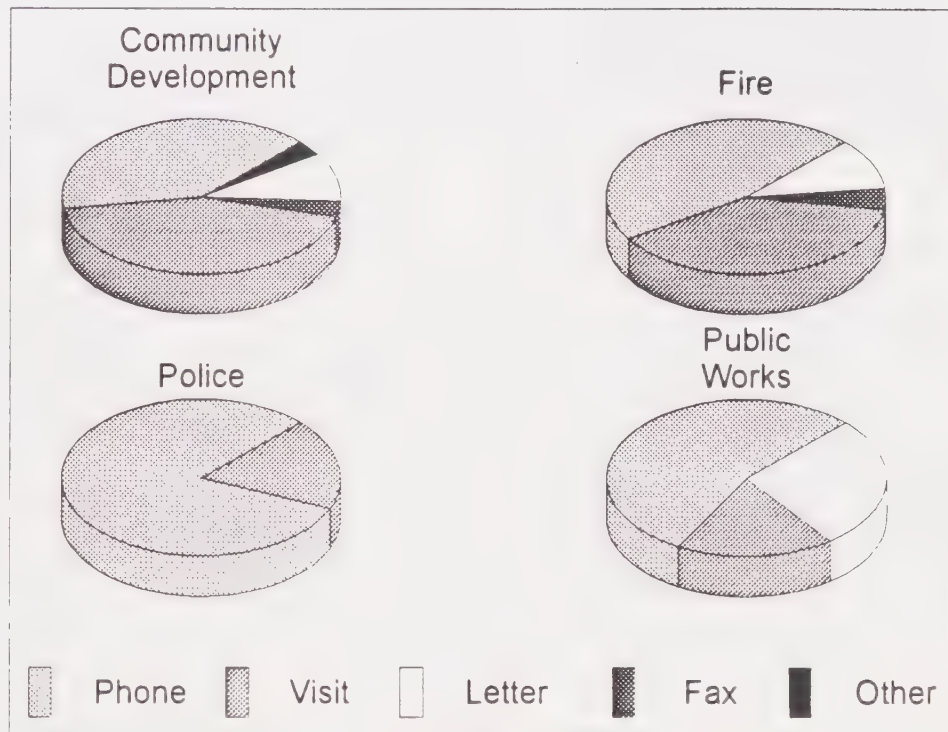


Figure 6

Businesses which identified contacts with the Police Department indicated that calls were made in response to a crime or other emergency. This explains the large percentage of contacts by telephone. In the case of the Fire Department, the large percentage attributable to personal visits was skewed by the fact that fire inspectors visited the business in the course of an inspection, thus initiating the personal contact.

Businesses which reported whether City contacts required more than one attempt, generally gave high marks to the City's service. Set forth below is a table which details the percentage of contacts that reportedly took more than one attempt to complete. Some departments are not included because the samples were too small. Emergency calls are not included in these responses.

Department	Percentage Requiring Multiple Contacts
Community Development	25.0%
Fire Department	23.5%
Police Department	15.4%
Public Works	33.3%

In general, businesses were not supportive of automating their specific contacts with the City. Anecdotal comments indicated that personal contact was useful and rewarding. The table below summarizes the responses to the question of whether their contact should be automated.

Department	Percentage Favoring Automation
Community Development	33.3%
Fire Department	9.4%
Police Department	15.4%
Public Works	66.6%

The response for Public Works was somewhat skewed by a respondent with multiple contacts with the department. The suggestions for automation techniques included E-Mail, computer bulletin boards, voice mail access, Internet postings and broadcast faxes. The low response percentage for the Fire Department may reflect the fact that many companies interact with the department for the purpose of fire inspections.

While not in favor of automating their existing, routine contacts, business owners did indicate they would use automated contact methods if they were available. Of those responding, 68.2% said they would use an automated voice response unit to check on the status of pending matters. 56.4% said they would use a computer bulletin board service. 53.9% said they would utilize an automatic system that sent postcard status reports.

#### *b. Frequency of Contacts*

The questionnaire asked each company how often it contacted the eight major departments within the City. The choices were: less than monthly; once a month; and, once a week. Most companies reported that they contacted the City departments less than monthly. The table below summarizes the frequency of contacts *occurring at least once a month*, reported by the universe of responding companies.

Thus, of the universe of companies reporting, 1.1% said they contacted the City Clerk's Office on an average of once a month. Another 1.1% reported that they contacted the Clerk's Office on an average of once a week.

Department	% of Reporting Companies	
	Once a Month	Once a Week
City Clerk	1.1%	1.1%
Community Development	6.6%	4.4%
Economic Development	2.2%	1.1%
Finance	5.5%	2.2%
Fire	11.0%	2.2%
Recreation and Community Services	1.1%	1.1%
Police	2.2%	1.1%
Public Works	5.5%	1.1%

It should be noted that the total sample of the "once a week" group was very small, only thirteen companies. Therefore, the results should not be assumed to have a high level of reliability.

The responses demonstrate that there are sufficient contacts between most City departments and the business community to support an investigation into methods of speeding and automating these recurring contacts. As reported above, there is a corresponding interest on the part of a significant portion of the business community (over 50% responding said they would use either an ARU or a computer BBS) to indicate that automated systems would be used if installed. However, the anecdotal comments written on the survey forms indicate satisfaction with the personal contacts that many businesses enjoy with the City staff. The introduction of automated information services to handle routine status inquiries might serve both interests. Routine matters could be handled automatically and quickly by a modern phone and computer system without the need to interrupt the normal work flow of the City staff. Meanwhile, with these systems installed, the staff should find that it has more time available to provide the "personal" touch when non-routine contacts are received.

#### Projected Trends in Rate of Contacts

The survey asked each business whether it anticipated a change in the frequency of its contacts with each of the City departments. Most businesses indicated that they do not anticipate increasing the frequency of their contacts with the City departments. Of those that did, however, most indicated that they anticipated increasing their present contact rate of "less than monthly" to monthly contacts. The departments which will be the most impacted will be Fire and Community Development.



Department	Anticipated New Contacts	
	Once a Month	Once a Week
City Clerk	2.2%	0%
Community Development	3.3%	2.2%
Economic Development	2.2%	1.1%
Finance	3.3%	0%
Fire	4.4%	0%
Recreation and Community Services	0%	0%
Police	2.2%	1.2%
Public Works	1.1%	0%

Thus, 2.2% of the companies reporting the frequency of their contacts with City departments predicted that they will increase their contacts with the Clerk's Office from "less than monthly" to "once a month." Similarly, 2.2% of those companies reporting that they presently contact Community Development "once a month" on average predicted that they will increase their frequency of contact to "once a week" on average in the future.

The sample size for the projected level of new contacts for all departments was small and cannot be relied upon in a statistical sense. It is offered for informational purposes only. The sample for the Finance Department was very small.

These trends suggest that Fire and Community Development will see a measurable increase in the level of frequent contacts. The survey form suggested that the respondent use a five year period as a guide, but it is likely that the increased contacts predicted by the responding companies will occur within a smaller window given the general nature of business to forecast its activity a year, or possibly two, in advance.

#### Responses to the Questions on Future City Telecommunications Facilities

In an attempt to sample the attitude of the business community toward possible City investments in telecommunications facilities, the questionnaire asked the respondent to select one of five levels of agreement with a series of statements concerning the City's future telecommunications plans. For example, the first statement read:

The City should install a computer 'bulletin board' type of service that the company could use to check on the status of pending applications for plans, building permits

and other types of approvals, look at agendas for upcoming council meetings, check on upcoming events, etc.

The respondent was then asked to indicate the company's agreement or disagreement with the statement on a five point scale:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
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Set forth below are the statements presented in the survey along with a summary of the responses, divided into three categories: agreement; neutrality; disagreement. Responses to "strongly disagree" and "disagree" were combined to make analysis easier. Similarly, responses to "strongly agree" and "agree" were combined.

1. The city should install a computer "bulletin board" type of service that the company could use to check on the status of pending applications for plans, building permits and other types of approvals, look at agendas for upcoming council meetings, check on upcoming events, etc.

9	36	39
Disagree	Neutral	Agree

2. The city should install a "voice response unit" which would allow a telephone caller to use an automated menu system to check on items like those mentioned in Question 1, above.

14	27	43
Disagree	Neutral	Agree

3. The city should install kiosks in convenient places with computer terminals that would allow the company to check on matters pending before the city departments, such as the items described in Question 1.

25	41	18
Disagree	Neutral	Agree

4. If permitted, the company would file planning documents, permit applications, license applications, etc., in electronic form with the city.

14	29	41
Disagree	Neutral	Agree

5. If available, the company would authorize the city to debit a company account for the filing fees associated with planning documents, license applications, etc. in order to speed processing time.

25	28	31
Disagree	Neutral	Agree

6. If the company could share E-Mail with city contacts, it would use the service to send and receive messages.

13	37	34
Disagree	Neutral	Agree

7. If the city established a WEB site (a "home page" directing users to City information) on the Internet to promote the development of new business in Milpitas, I think it would be a good use of city resources.

17	37	30
Disagree	Neutral	Agree

8. If the city established a WEB site on the Internet, the company would be interested in participating to promote its products and services.

17	37	30
Disagree	Neutral	Agree



9. If the city printed a regular report on the status of all pending applications before the city and placed it on the public counter in City Hall, the company would use the report for status checks.

21	39	24
Disagree	Neutral	Agree

10. If the city printed a regular report on the status of all pending applications and other matters, the company would be interested in subscribing to a service that delivered the report to the company's offices either physically or electronically.

30	37	17
Disagree	Neutral	Agree

Looking at the responses overall, the greatest degrees of support were expressed for the propositions that the City should: install a computer bulletin board service which businesses could use to check on the status of pending applications, etc. (Question 1); install a voice response unit for the same general purpose (Question 2); and, permit the filing of planning documents, permit applications, etc., in electronic form (Question 4). The least support was engendered by the following proposals. The City should install kiosks in convenient places with computer terminals to permit businesses to check on pending matters (Question 3). The City should print a regular report on the status of all pending applications before the City (Question 9). And, the City should

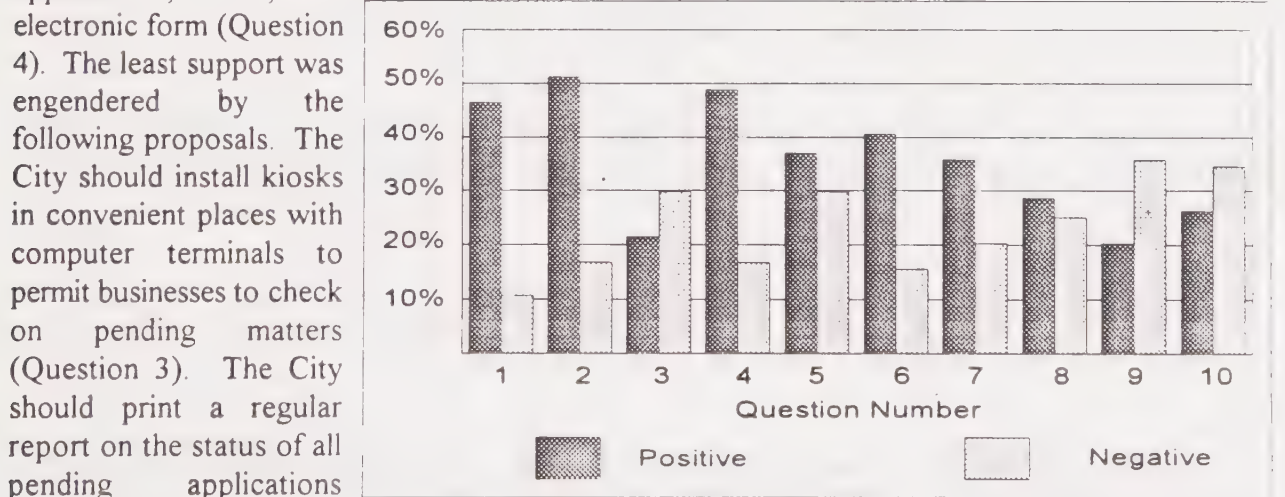


Figure 7

provide such information to a private service which could be accessed by subscription (Question 10). The negative responses to the last two questions may have reflected the desire of businesses not to make it easier for their competitors to find out what applications had been filed with the City.

Figure 8 indicates the relative deviation from neutral for each question. The deviation was calculated by assigning each response a value (from 1 for “strongly disagree” to 5 for “strongly agree”); taking the mean of all responses to each question; and subtracting the mean value from the neutral value (3) to get a plus or minus number. This is a useful way of viewing the “net” agreement or lack thereof a particular proposition garnered. Figure 7 displays the extent of both agreement and disagreement for each proposition.

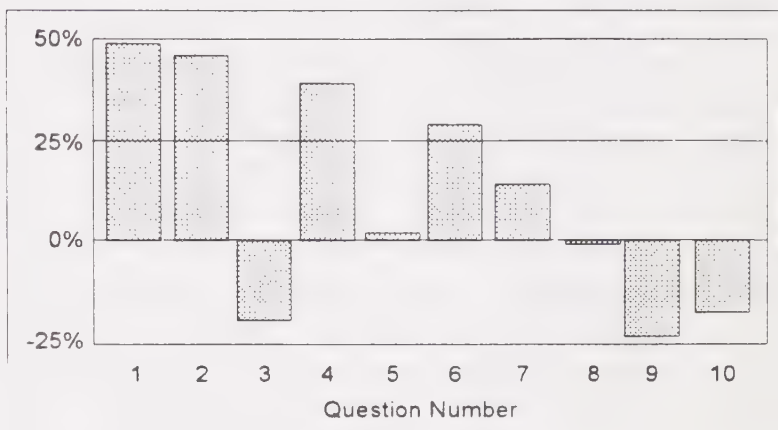


Figure 8

## VII. COMPETITIVE ACCESS PROVIDERS

Within Milpitas, there is presently no effective competition for either basic cable television service or basic telephone service. Off-air broadcast stations do provide competition to the cable company in the delivery of local television programming and broadcast network programming (NBC, ABC, CBS and Fox). However, the off-air stations (even taken as a group) cannot compete with cable in most households where cable networks like CNN and ESPN have become popular. And, while direct broadcast satellite operators, like Primestar and DirecTV, have made small inroads in suburban/urban cable markets, it is unlikely that these services will capture significant market share unless: the cost of the receiving equipment comes down from its present level of \$700, plus installation; or the satellite operators significantly reduce their monthly fees which are essentially the same as monthly cable fees.

Similarly, there is no present competition to Pacific Bell in plain old telephone service ("POTS"), business line services, Centrex and other "universal" services offered by PacBell. There is, however, developing competition in connecting large long distance customers to their long distance carriers, like AT&T, Sprint and MCI. A by-product of this competition is that cities, like Milpitas, are being approached by multiple companies seeking to dig up the streets to lay fiber optic cable. For reasons explained below, these companies are not inclined to share conduit or fiber cables.

Therefore, in the near future, it is likely that the City will face the implications of competition for telecommunication customers in the competitive access business. If wireline competition develops in POTS, or a second cable company seeks a franchise in Milpitas, companies may approach the City to install fiber, coaxial and copper cables to provide telephone and/or cable service. It is likely, however, that wireline competition is at least several years away. A second cable provider may appear in the form of Pacific Bell's hybrid fiber coax network. However, in MCG's opinion, the best case of the impact of competition on City resources, particularly public rights of way, is the CAP industry.

### *a. The Origins of the Competitive Access Business*

The local Bell operating companies, like Pacific Bell, are commonly referred to as local exchange carriers or "LEC's." A LEC charges long distance carriers an "access" fee for all long distance calls that are originated or terminated on the LEC's network. The long distance carriers, like AT&T, MCI and Sprint, maintain "points of presence" or "POP's" which are the physical locations where long distance calls leave the LEC's network and enter the long distance carrier's network. In the Bay Area, each long distance carrier (commonly referred to as an interexchange carrier or "IXC") maintains a number of these POP's so that the originating and terminating portions of a long distance call do not have to go far before it is "handed off" to the IXC (originating) or reaches the target of the call (terminating).



Access fees account for approximately 40¢ of every \$1.00 billed by a long distance carrier to its customer and are extremely profitable for the LEC's because there is virtually no incremental cost incurred in carrying the traffic. The existing local telephone network handles a long distance call just as it handles any call which begins and ends within the local network. The only difference is that one end of the call is a POP instead of a local number. In addition to the access fees, the LEC's typically provide the IXC's with billing services which also generate significant revenues for the companies.

*b. The Nature of the Competitive Access Business*

Competitive access providers ("CAP's") started out by connecting heavy long distance users with their preferred long distance provider's ("POP"), using the CAP's own fiber network in most cases. By avoiding the LEC at the originating point of a long distance call, the IXC immediately realizes a 20%± increase in profitability on the call. If the IXC can use a CAP at the terminating end as well, the increase jumps to 40%±. The CAP's customer, thus, is actually the long distance carrier and the access savings are split between the IXC, the CAP and the caller. Some CAP's, like Teleport Communications Group, for instance, "brand" their service with the name of a major IXC, like AT&T or Sprint, and handle the construction, connection and accounting functions for the IXC. Long distance callers may never be truly aware that their calls are being handled locally by a CAP instead of by the LEC. Ironically, the IXC will still probably use the LEC to do its customer billing, so the CAP's have invested heavily in network management and billing software that is compatible with the billing software used by the LEC's.

The major CAP's, which include Teleport, MFS Communications, CableVision Lightwave and Hyperion Communications, are busy building networks in as many cities as they can: (1) gain the necessary PUC permits to construct their private networks; and (2) garner the financing necessary to support the construction of the networks. The CAP networks are a combination of fiber rings constructed by the CAP's and, in some instances, network facilities leased from the local Bell operating company.<sup>4</sup> When a CAP becomes interested in a market, it obtains a "demand set" from one or more IXC partners in the market. The demand set gives the CAP the location and name of the major long distance customers of the IXC. These locations are plotted on a map and the CAP designs its network to pass these major long distance users and the POP's of the major IXC's. The demand set information is often available to more than one CAP, and that is a reason why the same routes are selected by the CAP's when they design their networks in a given area. It is also the reason that the same streets are opened, or bored, again and again by these companies. It is also the reason that the local Bell operating company will seek to construct along the same routes when it upgrades its own network in the next several years.

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<sup>4</sup> The CAP's try and connect their customers to the long distance POP's using a ring so that a physical break in the fiber cable will not necessarily disrupt service. As discussed in detail *infra*, fiber rings contain software and hardware that can detect a cable cut and can immediately reverse the flow of information around the ring if needed to avoid an interruption in service.

Heavy users of long distance service like to do business with CAP's for several reasons. As explained above, cheaper long distance rates are very important. However, many long distance users transmit critical data, video and/or control information (for computer-aided design and manufacturing, for instance) over the long distance networks and they therefore like the ring architecture employed by the CAPS. Customers like banks and stock brokers cannot afford to suffer interruptions to their data streams. These types of customers also like the fact that the CAP's fiber network is physically separate from the LEC's telephone network. This concept is called "route diversity" and it is a selling point to many long distance customers. If the LEC network fails, the customer's long distance traffic will continue. If the CAP network fails, the customer will simply revert back to the local telephone network until the problem is repaired. No traffic will be lost.

In addition to offering route diversity, some CAP's have installed switches in their networks to route their traffic over a back-up IXC should something happen to the network of the primary IXC. This concept is called "vendor diversity" and, in light of several major failures of the AT&T long distance network in the last ten years, is considered important to some long distance users.

### *c. The Future of the Competitive Access Business*

Recently, some CAP's have actually gone into the local exchange carrier business, providing telephone service from a telephone set all the way to the terminating point of the call. The best example of this is Teleport Communications Group, which operates the pay (coin) telephones located in LaGuardia Airport in New York City. TCG connects its pay phones to the local exchange carrier's network and pays NYNEX a connection fee. It makes its money on the difference between the cost of the connection fee and amount charged the user. In addition, if the user makes a long distance call, TCG uses its own fiber lines to connect the call to the user's long distance carrier and never pays a connection fee to NYNEX at all. Since a high percentage of the calls made from pay phones in airports are long distance calls, TCG's operations at LaGuardia are reportedly very profitable. TCG has announced that it intends to expand its local telephone business in New York State and has sought "co-carrier" status from the New York PUC. The States of Maryland, New York, Illinois and Washington have changed their laws to permit co-carrier operations and several others, including California, are moving toward co-carrier environments. Many analysts feel the CAP's may be in the best position to enter into direct competition for "plain old telephone service" once the barriers to a second local loop provider are dropped.

One of the CAP's, MFS Communications Company, Inc., has embarked upon a different course than most of its competitors. Instead of partnering with the IXC's and avoiding competition with them, MFS has announced that it will seek to connect long distance traffic which originates on one of its fiber networks directly to the terminating point using its fiber network in the terminating location. By reselling long distance service, MFS could, in essence become both the CAP and the long distance carrier and its customers would become the actual long distance callers and not the IXC's handling the traffic. Although MFS has constructed CAP facilities in many large markets, a significant percentage of its traffic will terminate in areas where MFS does not have a fiber network. Thus, the IXC's are likely to remain the largest customers of MFS for the foreseeable future and this



approach to the long distance by-pass business, competing directly with your largest customers, has been labeled as "risky" by some analysts.

*d. CAP Activity in the Bay Area*

There are two active alternative access providers (CAPs) committed to the northern California Bay Area, MFS Communications Company, Inc. (MFS), and Teleport Communications Group (TCG). Both have made significant investments in their Bay Area networks, including service areas that cover the City of Milpitas.

As more fully discussed below, MFS and TCG are planning to expand their businesses beyond CAP services. Wireline local service and PCS are important services to the TCG business plan and wireline local service is a high priority to MFS.

**1. MFS Communications Company, Inc. (MFS)**

MFS is an independent public company, traded under the symbol MFST on NASDAQ. It was started by Peter Hewet Sons' in 1987 and has multiple wholly-owned subsidiaries including MFS Telcom, which operates the CAP business.

As of June 1995, MFS was operating or developing networks in 39 locations in the United States. Its expansion rate has been high given that it served only 14 markets at the end of 1993. Its revenue doubled during 1994 rising from \$141 million at 12/31/93 to \$287 million at 12/31/94. In April 1993 it employed 654 compared to 2,971 at year end 1994. MFS has been built through a combination of acquisition and system construction to its present size. The investment houses of Smith Barney and Bear Stearns are both bullish about the CAP industry and its potential to evolve into the local exchange business. As a result they issued moderate buy recommendations for MFS in June 1995.

MFS is expanding the breadth as well as depth of its market as it prepares to enter the local wireline phone business. It has been positioning itself since 1993 to move beyond the CAP service on which the company was founded. Shortly after the California Public Utility Commission issued its new rules governing competition in the local loop on July 24, 1995, MFS, on behalf of a subsidiary, MFS Intelnet Inc., filed an application to compete directly with PacBell. In the application, MFS indicated that it had established CAP networks in Los Angeles, Oakland, Orange County, San Diego, San Francisco and the South Bay.



## 2. Teleport Communications Group (TCG)

TCG is a CAP company owned by a group of cable television operators, as follows:

TCI	30%
Comcast	20%
Cox	30%
Continental	20%

TCG operates on a national scale. Besides participating with its members' owned cable systems, it creates joint ventures in different major markets with the local cable operators, even if they are not among the TCG owners. This strategy is basic to the TCG business plan, in which it uses the facilities, and networks of local cable operators on a shared basis. In theory all parties benefit. The network costs and logistic hurdles are reduced for the CAP, while the operators acquire a potential revenue stream and learn about the telephony business from the inside.

TCG is not a publicly traded entity, allowing for little financial information. MCG has gleaned the following information from various sources available to it. At calendar year end 1992, TCG had estimated revenues of \$75 million and had 450 employees. Merrill Lynch predicted that the revenue would rise by 85% from 1993 to 1995 and that income would be negative until 1999, assuming no debt is carried. Merrill projects a negative NPV on TCG's investment of \$460 million through the year 2004 at a modest 12% discount rate. The investment only becomes positive after a residual market valuation is considered.

As of mid-1995 TCG was serving 21 major markets in the U.S.. Many of those markets coincide with the market specific licenses won by the PCS wireless consortium called Wireless Co.. As discussed elsewhere in this report, Wireless Co. is an attempt by Sprint, TCI, Cox and Comcast to enter the local telephone service business with the newly developed, recently auctioned, cellular like phone service. The consortium also intends to market a wireline phone service in some of these same markets and others. This service would directly compete with Pac Bell in the California market and especially in the Bay Area where TCG already has an under utilized switch in service. While regulatory hurdles remain to the full offering of the wireline service today, MCG believes there is little doubt that the consortium will win the right to serve the Bay Area through the California PUC or pending federal legislation that will override state and local obstacles.

## 3. Hyperion Telecommunications and Cablevision Lightpath

Both Hyperion and Lightpath are CAP entities owned by cable television operators. Hyperion is owned by Adelphia Cablevision headquartered in Cottersport Pa. the 7th largest U.S. cable operator (1.6 million subs). Lightpath is owned by Cablevision Systems, headquartered in Long Island NY, the 6th largest U.S. operator (2.6 million subs). Both are publicly traded and both are considered to have high leverage, although Adelphia has extraordinarily high leverage at 10.9 times annual cash flow.

Neither company has indicated an interest in offering CAP or local telephone service in the Bay Area. Hyperion has focused on the southeastern U.S., primarily Tennessee. It has recognized its financial limitations and like the TCG strategy mentioned above, co-ventured with local operators in Tennessee, such as E.W. Scripps and InterMedia Partners. Lightpath is making its service entrance in its own cable systems in Connecticut and New York state where Cablevision has a strong presence. Within the last month, Lightpath filed for co-carrier status in Connecticut and indicated that it intends to compete directly with SNET for local and long distance phone traffic.

## VIII. NETWORK PARADIGMS

There are three basic network paradigms, or models, which logically could be employed by the City. The first paradigm, which will be called the Dependent Network Paradigm (or Paradigm 1), is the present method utilized by the City: Reliance on the established networks provided by Pacific Bell and by South Bay CableVision to provide telephone and video services, respectively, to the City and its residents. The second paradigm, which will be called the Full Service Network Paradigm (or Paradigm 2), involves the construction and operation of a full service, hybrid fiber coax network to each residence, business and government building within the City. South Bay CableVision has constructed a hybrid fiber coax ("HFC") network in the residential areas of Milpitas and PacBell has announced its plans to build an HFC network in Milpitas as well. Finally, there is a third paradigm, which will be called the Internal Network Paradigm (or Paradigm 3), which involves the construction and operation of a private network between City buildings and used solely to carry the City's voice, data and video. Under this paradigm, voice, data and video would be delivered to residences and businesses in the City by competing, commercial networks owned by companies like TCI, PacBell, MFS, etc. For the reasons stated below, MCG recommends that the City construct an internal network (Paradigm 3).

These models are not mutually exclusive. Even owners of HFC networks, like South Bay CableVision, use the existing telephone network for voice communication between points located along its cable network. Presently, the City uses the existing telephone network owned and operated by PacBell and the HFC network owned and operated by South Bay depending on the nature of the communication. If the City constructs either a full service HFC network, or an Internal Fiber Network, it is very likely that some services will continue to be provided by PacBell or by South Bay.

### *a. The Dependent Network Paradigm (No. 1).*

Since the City is a long-time user of the existing networks owned and operated by PacBell and South Bay CableVision, a simple spreadsheet has been prepared which sets forth a summary of the City's telephone costs (see Exhibit G).

Some of the strengths of the present approach are:

- There is no capital cost associated with the distribution network. The investment and the risk has been taken by PacBell and South Bay CableVision.
- Technology upgrades will be made by both PacBell and South Bay to their networks at their expense. The technology cycle for replacing or rebuilding the distribution plant has, historically, been shorter in the case of the cable industry. Making modifications to the distribution plant to incorporate new technologies has, historically, been shorter in the case of the telephone industry.



- Maintenance and operational responsibilities for the networks will be undertaken by their owners. The City need not acquire the expertise to repair and replace worn or damaged distribution network components.
- Federal and state regulations assure a minimum level of service quality which in most offerings is quite high.

There are also negative considerations to relying on the present approach. Some of the negative factors are:

- The costs of using these networks is not fixed and is likely to rise over time. Even though cable and telephone are interested in capturing the other's business, it is unlikely that this will occur to any significant degree in the near future. Until open competition on all material lines of business develops, both cable and telephone will remain essentially monopoly services. In mid-September, 1995, PacBell asked the California Public Utility Commission to approve a ten percent (10%) increase in most business lines to offset losses incurred in the competitive intra-lata toll market to companies like AT&T, Sprint and MCI.
- New demands for bandwidth by the City will always entail a network cost. New services, such as video distribution and high speed data transport, are bandwidth intensive and the costs of using the public switched telephone network could be prohibitive.
- The cable and telephone networks have been designed to handle general applications and, therefore, will not be as efficient as a network designed for the City's specific use.
- Network modifications, such as temporary connections or service to a new facility, may be affected by the willingness of PacBell and South Bay to accommodate special requests on a timely basis and may be impacted by PacBell's tariff structure.
- The City will be bound to the technology cycles of PacBell and South Bay. If significant competition does develop between cable and telephone, it is possible that capital spending by these companies may be negatively impacted as revenues in their core business declines.

Weighing the negative and positive factors, the Dependent Network is not recommended as the basic paradigm for the City's primary telecommunications network. It is likely, however, that low bandwidth services, such as alarm signals, telemetry and control signals should be carried over the existing switched telephone network, particularly from remote sites.

b. *The Full Service Network Paradigm (No. 2).*

This is considered the most “exciting” of the three paradigms by some municipalities because it involves the construction and operation of a full service HFC network in competition with the HFC network operated by the local cable operator and the telephone network (evolving to an HFC network) operated by Pacific Bell. This is also the riskiest and most capital intensive paradigm.

A “full service” network is one that delivers video, voice, data, and interactive services to business and residential areas of the City. In contrast, the present South Bay system, while a true HFC network, is not a “full service” network because it is essentially one-way and only delivers video entertainment services to residential areas of the City. Similarly, the existing telephone network, while universally available, cannot handle high speed data without special conditioning and cannot handle multi-channel video delivery because of bandwidth limitations. The new HFC network being built by Pacific Bell is designed to be a full service network.

Several companies, notably Spectranet, have proposed that municipalities own their own full service HFC networks in partnership with a private operator who constructs, maintains, operates and markets the network to all customers. Because municipal ownership of public networks, either solely or in partnership with the private sector, has been the subject of much discussion among municipal telecommunications officers, MCG constructed a financial model to examine the viability of a City-owned full service HFC network.

Attached to this report as Exhibit H is a financial model which analyzes the projected cost of constructing a full service HFC network in Milpitas. While the model is quite large, the salient facts are summarized on the first three pages. In order to understand the projections and to test the specific assumptions used to construct the model, certain general presumptions must be understood:<sup>5</sup>

- It is assumed that the network is a star configuration with one headend. It is assumed that each fiber node covers 500 homes, resulting in 36 initial nodes. The network is designed to offer cable, data, telephone and interactive services.
- It is assumed that the network will not originate and terminate intra-lata toll calls without going outside the network because of its size. It is assumed that Centrex is not offered by the network. It is assumed that the network can access the points of presence for the major long distance carriers without using PacBell's network.

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<sup>5</sup> The assumptions used in the model were aggressively chosen to drive the model toward financial viability. As will be discussed in detail, *infra*, it is difficult to make a business case for building a full service network to each home and business in Milpitas because of the existing services provided by PacBell, South Bay CableVision and the CAP's.

- A competitive environment is assumed for cable and telephone services. Thus, service penetrations for each line of business reflect the assumption that at least one other network already provides telephone and/or cable service to each home or business. This would be the case in Milpitas if the City decided to build its own network.
- It is assumed that the network is built in two years and is capable of providing all services to approximately one-half of the homes passed by the end of the first year. This speeds up revenue production and compresses the capital outlay for network construction. It is assumed that single family houses increase by an annual growth of 2.0% for the remaining eight years.
- The model assumes the network is designed to provide service to all businesses and residences located within the City. A typical cable network, in contrast, is generally designed on the assumption that it will eventually provide service to 100% of the homes, apartments and condominiums located within the franchise area, but it is generally not designed to provide service to businesses.
- Existing rates for major services, like basic residential and business telephone service and basic (plus tier) cable service have not been reduced. This assumption may overstate revenues derived from each projected customer.
- The model assumes that only 25% of customers who take telephony, data and demand side management services do not take cable service. This assumption, which tracks projections made by cable television companies keeps capital costs down for customer service drops and terminal equipment.
- It is assumed that the average business has 7.8 telephone lines.

### 1. Capital Costs.

Based on these general assumptions, the model projects that a full service HFC network serving 18,000 homes initially would entail capital outlays of \$24,446,408 over a ten (10) year period. This equates to an investment of \$1,159 per home passed -- which is consistent with projections made by cable television companies for similar networks. It should be noted that this figure would be higher if the cost of telephones was loaded on the network. It is assumed that telephony customers buy their own phones.

Construction cost estimates are based on the experience of the MCG personnel, who have supervised the construction of HFC networks in the past several years. It is also assumed that the network begins operations using a digital set-top box costing \$350 apiece. At present, it is unclear whether General Instruments, which is making the first digital set-top (and still has not achieved



production), can produce and sell the box at a price below \$400, even in quantity. Therefore, it is believed that the capital assumptions are appropriate for an aggressive analysis.

It is assumed that the headend/central office constructed by the City includes a new, modular telephone switch. Several vendors make such a switch. Nortel (Northern Telecom) makes the DSM 500 digital telephone switch which contains the basic switching functionality of a CO switch and some of the higher functions of a tandem switch (such as billing information). A DSM 500, with appropriate software, costs about \$1,000,000, which is the cost assumed in the model.

The model assumes that headend cable and telephone equipment is purchased in the first year. Thus, all modulators, processors, switches, satellite antennas and receivers, etc. are loaded into the first year of network operation. It is assumed that additional telephone and data equipment is purchased as the customer base for these services grows. The capital cost of terminal equipment (set-tops, modems, etc.) is paced to match the growth in the customer base utilizing that equipment.

## 2. Operating Revenue

Operating revenue is composed of two elements: volume and rate. Volume is expressed as the percentage of customers for a given service divided by homes passed by the network. This percentage, usually referred to as "penetration" in the cable industry varies by type of service. According to the National Cable Television Association, in 1994, cable television provides basic (and tier) cable service to an average of 63% of homes passed (on a national average). In contrast, the cable industry provides premium cable services (like HBO) to approximately 30% of the homes passed by cable plant. Basic telephone service, in contrast, is provided to almost 100% of homes passed by telephone plant. The model assumes that the network is the second provider of both cable services and telephone services when it is constructed. Cable penetration by the City network is assumed to start at 7.0% and climb to 28.0% by the tenth year of operation. Residential telephone penetration is assumed to start at 5.0% in year one and climb to 25.0% by year ten.

Rates are set at the approximate level of present telephone and cable rates. While it may develop that these rates will fall as soon as a second provider becomes available, the model does not make that assumption. Moreover, the model assumes that rate levels grow with inflation in all categories except traditional movie PPV, which has already started to decline because of competition from video stores. It could be argued that rates for cable and telephone services will actually decline, or at best, remain flat because of competition. However, it was decided to use an aggressive revenue approach to make the best possible case for the Full Service paradigm.

## 3. Operating Expenses

Operating expenses were estimated by applying operating margins to each line of revenue. The cable operating margins are based on MCG's experience and were inflated somewhat to account for the synergies of operating a full service network. Telephone margins were estimated based on published data and estimates given by experienced telephone professionals. It should be noted that

the margins for telephone services exceed the authorized rate of return for such services established by the California Public Utilities Commission, but it is believed that the margins are good estimates of the actual operating experience of PacBell.

The operating margins for new video services, such as interactive movies, shopping, game playing, etc., were estimated through analogy to existing PPV and game services. Operating margins for new data services were estimated based on conversations with persons involved in market tests and margins for demand side management were estimated based on conversations with power industry professionals who have experience with actual DSM operations.

#### 4. Free Cash.

A simple way of measuring the viability of a network operation is to examine free cash. Free cash is operating income (before interest, depreciation, amortization, taxes, etc.) less capital expenditures. As summarized in the table below, in the Full Service Network model, the enterprise shows negative free cash for the first three years, reflecting heavy expenditures to build the distribution network and purchase the necessary headend and central office equipment in the first three years. Thereafter, free cash is positive.

in (,000)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Revenue	320	1216	2167	2940	3781	4697	5698	6793	7992	9307	44,910
Op. Exp.	197	756	1360	1860	2403	2995	3643	4351	5127	5979	28,671
Op. Income	123	460	807	1080	1378	1702	2055	2442	2865	3328	16,239
Capital Exp.	9215	6660	1024	746	1084	1258	1143	1173	900	1242	24,446
Free Cash	(9092)	(6200)	(217)	334	294	444	912	1269	1965	2086	(8,207)

Over the ten year period free cash nets (\$8,200,000). However, the net present value of the free cash flow of the unleveraged project over the ten years is (\$9,750,000) at a 6.0% discount rate, without a residual market value component.<sup>6</sup> If a residual market value is added, the NPV of the cash flow over ten years rises to \$8,800,000.<sup>7</sup>

<sup>6</sup> The discount rate was chosen to reflect the hypothetical opportunity cost for a municipality for traditional public works projects. Clearly, the construction and operation of a full service network for the purpose of competing in the telecommunications marketplace would entail a significant risk premium which is not reflected here. This evaluation assumes, in essence, that the capital investment to construct the network is funded by the municipality from the general treasury, or from some other source other than borrowing.

<sup>7</sup> This is something of a hybrid analysis because the residual market value is based on a 10x multiple of the operating cash flow in the tenth year -- a common valuation method for commercial cable television networks -- even though it is assumed that the asset will remain a municipal service in perpetuity.



If it is assumed that money is borrowed to fund the capital construction and operation of the network during years when free cash is negative, it is submitted that a more traditional commercial analysis, using the internal rate of return (IRR) formula, is a more appropriate way to value the project. Running the IRR on principal borrowings, positive free cash, interest accrued and residual market value (net of debt repayment) produces an estimated IRR of -4%. Not the kind of return that would support a viable commercial project.<sup>8</sup> Obviously, the Full Service Network modeled here does not produce an attractive investment in a commercial sense.

Many cable operators have found that the useful life of modern coaxial cable (not electronics) is in excess of twenty years. It is possible to derive positive NPV's and better IRR's for the network over twenty years, but the reliability of such a long term projection is questionable. Nevertheless, if the network were constructed as a municipal asset instead of a business, it might be justified using a long term analysis. This course of action is not recommended for the reasons discussed under the Internal Network section.

The model supports commercial viability if it is assumed that the network is built by an existing cable company with the cable market share of a single provider. However, it is not logical to base the Milpitas model on similar assumptions because it is illogical to assume that a new competitor can garner a market share in cable services or in telephone services substantially in excess of an even market division between capable competitors offering similar services at similar prices. Thus, if there are three cable providers in the City (South Bay, PacBell and the City), logically, each provider, over time, should capture one third of the cable market. If there are four telephone providers in the market [PacBell, Wirelessco (TCI's PCS partnership), AT&T and the City], each provider should capture one fourth of the overall telephone market, assuming they are all good competitors.

Therefore, for the reasons discussed above, the adoption of a Full Service Network paradigm by the City cannot be recommended. The model also suggests that such a network could not be operated successfully in a competitive environment by a commercial partner unless very aggressive penetration levels are assumed for core telephone and/or cable services. Before it accepts a proposal to partner in such a venture, the City should investigate the operating assumptions carefully.

Finally, an examination of the cost of building the distribution portion of the Full Service Network shows that three-quarters of the cost of construction lie in the coaxial, drop and terminal equipment portions of the network. These costs would not be incurred if a fiber network were constructed to connect government facilities and not constructed to connect to homes and businesses. The table below summarizes the cost allocations for the full service network modeled in this report:

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<sup>8</sup> As in the case of the NPV analysis, a 10x multiple was used to compute residual value. Taxes payable by any entity involved in this analysis are ignored.



Distribution Component	Estimated Cost	Share
Fiber Plant	\$4,345,992	22.4%
Coaxial Plant	\$7,357,124	38.0%
Customer Drops	\$466,869	2.4%
Terminal Equipment	\$7,217,277	37.2%

The cost of electronics is not included in these figures, with the exception of the amplifiers necessary to run the coaxial plant. While the fiber component of the full service network accounts for approximately 22% of the distribution costs, a simple fiber ring in Milpitas, without coaxial nodes, would be far less expensive to build. A ring around the City, estimated at 10.5 miles, would cost approximately \$344,000 to build, if existing (and proposed) conduits are used to house the fiber. If new conduits are laid in lieu of using existing, occupied conduits, the cost would be approximately \$446,000 for the ring.<sup>9</sup> In each case, the cost of terminal equipment, including PBX and other telephone equipment, and internal wiring would be additional. The details of this approach are discussed in subsection (c) below.

*c. The Internal Network Paradigm.*

Given the extreme capital burden of a full service network and the limitations of the dependent network paradigm, the logical question arises: What if the City connected the major City facilities and used the network for the sole purpose of carrying its own information (and, perhaps, information for other governmental entities, such as the Milpitas Unified School District)? A financial and technical analysis suggests that such an approach is both economically attractive and technically functional.

1. Network Design.

Attached as Exhibit I is a map which shows a possible layout for a fiber ring that would encompass the major downtown area of Milpitas and, with connecting fiber runs, pass all major City facilities, the County Library, the MUSD administrative offices, and most schools located within the

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<sup>9</sup> In the "maximum" estimate, it is still assumed that whenever new public works projects are undertaken, conduit is installed to carry the fiber cable. It is also assumed that "future" phases of the recycled water project and the traffic control project are completed within the next five years.

In the case of new traffic control conduits, it is assumed that conduits of at least 3" are used to carry both the traffic control cable and the fiber cable. In the case of the recycled water project, it is assumed that new conduit is laid when the street is opened for the installation of the water pipe. In the case of the recycled water project, the cost of the fiber, the conduit and the labor to install the conduit and fiber is included in the minimum estimate, but the cost of excavation is not. An exception is the first phase of the recycled water project, which will contain conduit because the installation of two, 3" conduits has already been approved by the City Council. In that case, the cost of the fiber and the cost of pulling the fiber is included.

City. The route proposed for the ring was selected to follow, in almost all cases, existing conduit and conduit which will be installed for other municipal needs, such as traffic control. In order to take advantage of the cost savings created by using conduit installed during proposed and future public works projects, the plan calls for building the network over a five year period. Moreover, if the City runs fiber through conduit already approved for installation during construction of the first phase of the recycled water project, the City will be poised to connect its facilities with other cities in the region using a City-owned network with virtually unlimited bandwidth.

The network, as proposed, would be essentially fiber to the service site. There would be no coaxial component to the network. MCG has significant experience with both coaxial cable and fiber optic cable installations. While coaxial cable is useful in many applications, particularly when a broadband feeder cable is needed to drop service off to many customers along its path, fiber cable costs about the same as coaxial trunk cable and has superior transmission characteristics and far greater capacity when the cable is used to run from point to point. Thus, fiber is recommended.

The network would be capable of carrying voice, video, data, telemetry and control signals. The City could connect new terminal devices to the network without bandwidth constraints and, possibly, could lease bandwidth to other commercial and governmental users passed by the fiber network.

The network is designed to be a ring, or closed loop. The advantage of the ring architecture is that a single break in the ring will not cause an interruption in service to the users connected to the ring. Modern hardware and software detects a break in the fiber, should one occur, and immediately routes communications around the break. See Figure 11, *infra*, which shows a break in a fiber ring connecting MUSD's administrative complex to City Hall, the Public Works complex and the Senior Citizens' Center. Although the break is shown between MUSD and City Hall, information between the two will continue to flow by going around the ring the "long way," passing through the Public Works building and the Senior Center to reach City Hall. Until the ring is complete, the City will use its connections to the PacBell network as its backup in case of a fiber cut. Once the ring is complete, the City will still connect some phones directly to PacBell and could use the public, switched network in the extremely unlikely event that the entire City-owned system failed.

The network could not, however, provide services to residents and businesses on a universal basis, as the Full Service Network would. As discussed below, the public, switched telephone network would be connected to the Internal Fiber Network through a City-owned PBX, and, thus, the fiber network would be used to originate and terminate traffic on PacBell's network.

## 2. Cost of an Internal Fiber Network.

Exhibit J is a spreadsheet which estimates the cost of an Internal Network over a ten year period. As discussed earlier, the model displays a "minimum estimate" which is based on the use of all existing and planned conduit. It also displays a "maximum estimate" which reflects the assumption that all planned conduit will be utilized, but that all existing conduit cannot be used. As can be seen,



the entire five phase project is projected to cost between \$361,000 (the minimum estimate) and \$477,000 (the maximum estimate).

The use of existing infrastructure and the opportunity savings arising from the use of other public works projects that open the streets along the fiber path, are estimated to result in a total savings of over \$400,000, or 54%, over the "normal" estimated cost of \$750,000 (excavating the streets to install fiber and conduit). The estimate includes the electronics associated with the operation of the fiber ring which are estimated to be about \$12,000 for each major site connected to the network for voice and data traffic. It also includes the estimated cost of backup power for the two major fiber hubs in Public Works and in City Hall (and for the City's new phone system). Video capability, which is not included in the estimate, could be added for approximately \$15,500 per site (plus cameras and monitors). Terminal equipment, such as data modems, telephones and computers are not included in the estimate because they would be purchased (or leased) regardless of whether the network utilized by the City was public or private in nature. Similarly, internal wiring is not included in the estimate.

Assuming that the City connects the City Hall complex and the Public Works building in the first phase and uses the fiber connection to install PBX's in each location to carry internal phone and data traffic and to connect the internal phone system to the PacBell network, the cost of the fiber component of the network and the basic electronic equipment used to transmit and receive voice and data between the two nerve centers of the City will be more than offset by the net present value of the Centrex savings for the ten year period (see full discussion in Section IX-D, *infra*).

In Phase II, the remainder of the inner fiber ring will be constructed, connecting the Senior Center and Fire House No. 1 to the network. In this phase, fiber would also be run south on Abel to connect to conduit which was installed in the Tasman Overpass project. Using this existing conduit, Fire House No. 4 will be connected to the network. If Phase I is completed, Phase II would cost an estimated, additional \$108,00 (if existing conduit can be used). This includes the cost of connecting Fire Houses No. 1 and 4, and the Senior Citizens' Center to the network.

In Phase III, the ring would be extended to the east to pass the MUSD administrative complex the Sports Center and Fire House No. 2. The ring would then run north until it hit Jacklin Road. From there it would run west until it connected to the inner ring at the intersection of Jacklin and North Milpitas. The estimated cost of Phase III would be \$104,000, including the electronics needed to provide voice and data to the Sports Center and Fire House No. 2.

Phase IV would extend the ring to the south. The ring would pass the large MUSD complex on Yellowstone Street. The estimated minimum cost of completing this phase is \$12,000.

Phase V will involve the installation of fiber in the conduit installed during the first phase of the recycled water project. Remote sites, such as some of the pump station locations, which presently have low voice and data traffic levels, and no video traffic, will be passed during this phase. However, given their low levels of traffic, these sites could continue to use the public network. The



completion of this phase will place fiber across I-880 at a second crossing, complete the western ring and place fiber at the gateway to San Jose and Santa Clara at the western border of the City. It is estimated that this phase will cost an additional \$49,000.

As the above discussion makes clear, once the fiber ring has been constructed and the core City facilities connected, the decision to connect other sites will depend on the services desired and the cost of the terminal equipment. The basic distribution network costs will have been fixed and yet the total network bandwidth will remain largely available to satisfy future demand.

For these reasons, MCG believes that the Internal Network Paradigm is the most appropriate model for the City of Milpitas. Adoption of this approach will provide the City with a state-of-the-art fiber network at minimal fiscal impact.

However, before discussing the specific recommendations concerning the fiber network, the recommendations concerning improvements in the City's telephone system and computers should be presented.

## IX. MASTER PLAN RECOMMENDATIONS

The Master Plan recommendations are divided into several discussions. The first deals with overall recommendations concerning facilities improvements and staffing requirements for the City generally. The second deals with specific recommendations for each department based on interviews with City employees during the internal needs assessment. The final section deals with recommended improvements to the infrastructure of the City.

This report has already made clear that a major recommendation is the establishment and operation of a City-owned fiber ring which will connect all major City facilities (see discussion on network paradigms). While the network could be discussed in detail first, it seems more logical to discuss initially the *information* that can be carried on a fiber network in order to provide information for determining the *value* of a private fiber network to the City. An analogy might be the construction of a new bridge. Discussing the structural design of the bridge should follow a discussion on the need for building it. Therefore, the recommendations section starts with a discussion of telephone and computer changes that will improve the production of information by the City and thus support the creation of a high speed network with virtually unlimited capacity.

Finally, it should be noted that the recommendations set forth herein assume that the City Hall building will remain at its present location. If the building is moved, then the recommendations relating to the design of the fiber ring might be affected. If the building is torn down and rebuilt at its present location, then the timing of the recommendations might be affected, but the substance of the recommendations would not change. In fact, if City Hall is replaced and significant numbers of staff are relocated temporarily in the Community Center during construction, the project could proceed apace by placing the new telephone system in the Community Center during construction.

### A. FACILITY IMPROVEMENTS

#### *1. Telephone System*

The City should install its own telephone system and place less reliance on the Centrex service offered by Pacific Bell. Not only will the use of modern PBX equipment result in significant savings over time, but such equipment will permit the City to utilize the phone system to automate a number of public information functions. Moreover, the fiber connection between the City Hall complex and the Public Works complex, recommended as the first phase of the fiber ring project, will provide the City with the same essential functionality that Centrex supplies, i.e., the two complexes will appear as one "virtual" building to a telephone user. If the fiber ring is extended to connect other major City facilities, the concept of the virtual building will be extended to those buildings as well.

It should be stressed that the recommendations concerning the telephone system are valid regardless of whether the City chooses to build the fiber network proposed herein. Obviously, if the City chooses not to connect the City Hall complex and the Public Works complex with its own fiber

cable, it will incur the costs of using PacBell's lines to effect the connection. Thus, the net savings estimated herein would be impacted by the additional cost of leasing the PacBell lines.

a. The Concept.

MCG has conducted a preliminary review of the City's telephone system and has determined that an opportunity exists to offset a significant portion of the fiber network costs by transferring many of the Centrex functions to a City-owned telephone system.<sup>10</sup> In order to provide back-up service in case of a catastrophic failure of the City's phone system, each PBX would have central office lines connected to telephones in each building which would continue to function even if a PBX suffered a total failure.

Conversely, use of a private phone system and a City-owned fiber network connecting all major facilities will permit the City to maintain communications (both voice and data) during a failure of the public telephone network.<sup>11</sup> This may be particularly valuable if the emergency causing the telephone failure also triggered the opening of the Emergency Operations Center located in the Public Works building. The EOC would be connected to the City's fiber network, thus using a different physical route and different physical facilities for voice and data than the public network (achieving "route diversity" discussed in the earlier section on the competitive access providers). Further, internal voice and data communications would not be affected by the traffic load of the local central office, which can increase dramatically during an emergency situation.<sup>12</sup>

Installation of a private telephone system will also permit the introduction of several features that were requested by many City employees during the internal needs assessment. While some employees have access to voice mail, many do not and a number of City employees felt that universal voice mail would be very useful. The employees that do have voice mail requested that the telephone sets be equipped with a message-waiting light so that they would know when they had received a message. Pacific Bell can provide voice mail services, but the cost is significant. PacBell cannot control a message-waiting light through its Centrex service at this time.

The use of a private telephone switch would also permit the City to install an automatic response unit ("ARU") which could be used to dispense various kinds of information including: account balances for water and sewer customers; information on trash collection; summary information on agenda items; information on common ordinance questions, such as barking dogs, RV parking, etc.; and information on road construction and public works projects. While many people

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<sup>10</sup> Estimates of the potential savings from Centrex access fees and from private line fees are discussed in detail in subsection d, *infra*.

<sup>11</sup> The telephone system would also continue to operate during a failure of the public power network because under the proposal each PBX and its associated fiber hub site would be equipped with back-up power.

<sup>12</sup> If the City constructs the full fiber ring recommended in this study, the City's fiber network will also survive a cut in its own lines.



do not like ARU's, both the business survey and the general public survey indicate that an ARU would be used by many people for routine information requests.

#### b. The Specifics

The greatest usefulness of a City-owned fiber network will come from the integration of City-owned PBX equipment and the optical link. While a specific design must be solicited from a number of vendors, MCG did discuss the possibility of integrating modern PBX equipment and a fiber link between City Hall and Public Works with Northern Telecom (now known as "Nortel").<sup>13</sup> Nortel is the vendor that supplied the Meridian telephones which are utilized by some City employees. These phones work with Meridian key service units located in both City Hall and Public Works and provide enhanced features not present on the "Unity" phones connected directly to the Centrex lines. Most of the telephones used by City employees are Unity sets.

The Nortel representatives reviewed their files on the City's phone system and, with MCG and City staff members, visited both City Hall and Public Works. After discussing the fiber project in some detail, it was their opinion that the greatest functionality would be achieved by installing a PBX unit in each building. The fiber link would connect the two units and essentially form one, larger unit serving both buildings and, eventually, both complexes. Since neither unit would be operating at capacity, there would be the additional advantage of (partial) redundancy in case of a failure by one of the units.

While the costs of installing the equipment must be solicited in open bidding, the Nortel representatives believed the bids made to the City in the 1991 telephone RFP would be useful for estimating the cost of installing new PBX equipment. The Nortel representatives also believed that most vendors could incorporate most or, perhaps, all of the telephones presently owned by the City into a new system. However, it is unclear whether the present sets can display a visual cue for voice mail, which was the single most requested telephone feature mentioned in MCG's employee interviews by existing voice mail users. It should also be noted that some cost savings may be possible by incorporating the existing Meridian key service units into the overall design. For purposes of this analysis, however, it has been assumed that the City will install two new PBX units without utilizing the existing key service units and will purchase new telephones.

The implementation of this plan, which may be delayed by the term of the City's Centrex contract with PacBell and by the need to replace or make repairs to City Hall, would provide full voice mail and telephone sets with other advanced features to City employees located in City Hall and Public Works. For a relatively small incremental cost (about \$2,500), these new services could be

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<sup>13</sup> Throughout this discussion, references to "City Hall" actually refers to the three buildings located on the same property -- City Hall, the Community Center and the Library. It is assumed that these three buildings will be interconnected and will be treated as one "virtual" building for network purposes. Similarly, "Public Works" refers to the Public Works/Police Department building, the warehouse, the office building located in the Yard and Fire House No 3. These buildings are presently interconnected with conduit, some of which is empty and, on a first physical inspection, seemed to have adequate capacity to handle the cable associated with voice, data and video (if desired).

extended from the Public Works building to Fire House No. 3 and to the City Yard through existing, unoccupied conduits. For a slightly higher investment (around \$5,000), conduit could be laid between City Hall, the Community Center and the Library. The new telephone equipment could also be used to support the installation and use of an automatic response unit to handle many routine status inquiries by the public and businesses -- such as the amount of a user's water bill or the status of an application for a building permit. As discussed earlier, both the public survey and the business survey determined a high likelihood that a well-designed ARU would be used by both groups. A modern ARU system can be installed for less than \$25,000.

#### c. Recommendations.

Therefore, it is recommended that the City:

1. Install the fiber link between the City Hall complex and the Public Works complex as more fully discussed in Section IX-D, *infra*.
2. Review its contract with Pacific Bell to determine when it may terminate or reduce the level of its Centrex service.
3. Issue an RFI to determine which PBX equipment will: (1) best utilize the fiber link to create a virtual building between City Hall and Public Works; and (2) integrate best with the ARU equipment to be installed by the City. The ARU vendor and the PBX vendor will likely be two different companies.
4. Prior to the expiration or modification of the Centrex contract, issue an RFP for new PBX equipment. The City has previously used a telephone consultant to assist it with this process and that may prove useful again.
5. Install the PBX equipment as soon as the fiber link is completed between City Hall and Public Works.

#### d. The Cost.

As detailed in Exhibit K hereto, the 1991 telephone system bids have been broken down into their major components for equipment and labor and then adjusted to reflect the usefulness of the equipment installed in 1991. For purposes of this analysis, it was assumed that: (1) switch prices have remained stable; (2) 85% of the wiring installed in 1991 is still useful; and (3) 75% of the telephone sets in City Hall and in the Public Works/Police building will be replaced with new units. A new voice mail system is estimated at \$40,000 installed with the new phone systems and is included in the cost estimate.

Using a ten year depreciation period for the PBX equipment and the estimated monthly cost



savings arising from the discontinuation of most of the Centrex lines used by the City<sup>14</sup>, MCG estimates that the City can install a modern telephone system in City Hall and Public Works for an estimated capital outlay of \$390,000.<sup>15</sup> If the cost of connecting the City Hall complex to the Public Works complex is included, the total would be \$460,000. The actual incremental cost, after taking into account the net present value of the Centrex savings over the depreciated life of the PBX equipment and the estimated costs of maintaining the PBX equipment, would be an estimated *savings* of \$37,000 over the ten year period.<sup>16</sup> The Nortel representatives indicated that capital leases are available to municipalities for the acquisition of PBX equipment so that the amount of the actual cash outlay could be controlled, but there would be a concomitant decrease in the realized savings due to the lease cost.

## *2. The Computer Systems*

### a. Need to Establish a Computer Network.

The City presently operates without a coordinated plan for integrating personal computer functions.<sup>17</sup> Each department has developed its own computer applications and, in some cases, networks, to support its operation. This has been done without the benefit of an overall computer plan and, therefore, information cannot be shared easily between departments. For instance, Recreation and Community Services does not use the address data base maintained by Public Works for water and sewer service to generate labels for informational mailings even though that data base is generally described as the most accurate in the City. As a result, Recreation and Community Services cannot easily target information on events or new services to the logical consumers of those services (by City quadrant, for instance). The Fire and Police Departments each maintain their own data bases and the Fire Department creates its own maps instead of relying on the Engineering

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<sup>14</sup> The estimate of Centrex savings was made by MCG after reviewing the City's phone bills for a recent twelve month period, discussing the charges with Pacific Bell and reviewing the matter with senior Nortel representatives. The savings estimate includes some savings in private line costs as well, but for simplicity, all estimated savings are referred to as "Centrex savings." Costs associated with operating a PBX, like number rental and CO and DID line connections to the PBX have been "netted out" of the projected Centrex cost savings. Included in the model is the estimated cost of maintaining the PBX equipment (estimated at 5.0% of equipment cost annually -- increased by inflation over the period).

<sup>15</sup> MCG discussed the possibility of using existing telephones with new PBX equipment with several senior people at Nortel (which is an MCG client and the vendor for the Meridian systems used by the City). They were of the opinion that both the Unity phones and the Meridian phones could be used with a new system. However, they were less certain whether a message-waiting feature could be incorporated into the existing phones.

<sup>16</sup> If the existing traffic control conduit cannot be used and new conduit must be installed, MCG estimates that the project cost, including the telephone costs as discussed above, will run approximately \$500,320. Over the ten year life of the telephone equipment, the net cost after Centrex savings, is estimated to be \$1,294.

<sup>17</sup> The issue goes beyond the relationship between the City and its data service company, which is currently under review. The scope of this study specifically did not include the City's relationship with BRC and it is not discussed herein.



Section in Public Works to create maps for it. Several other mini-computer networks have been created in the City, but none are connected.

The City needs to develop a coordinated plan for upgrading its computer facilities both to improve the functionality of the equipment and to permit the sharing of information across departments. It also needs to integrate the existing (and proposed) computer networks in the City into one network used throughout the City. This can be done without compromising networks created to perform specific tasks and without threatening the security of confidential information maintained by Finance, Fire, Police and others. However, the basic word processing and spreadsheet software used by City employees should be standardized on the network.

The utility of a local area computer network ("LAN") goes beyond the ability to share software and files; nevertheless, that basic functionality is important. During the internal needs assessment, several employees mentioned that they would like to have access to word processing software so they could create their own documents and share documents in their work group. Others indicated that they would like to be able to edit word processing documents electronically instead of passing paper back and forth. This is especially time consuming if the paper must pass between departments.

Several employees mentioned that they would like to work at home, but cannot connect their home computer with their computer at work. A LAN could be designed to support work-at-home and improve productivity.

A number of employees indicated that they would like E-Mail. While E-Mail is used by the Fire Department, Public Works and by some senior staff members at City Hall, it is generally not available in the City. A LAN would make E-Mail available to each computer user and would facilitate communication between people and also support the broadcast of documents like council agenda's, memo's, etc. In addition, a communications gateway on the network could permit employees to receive Internet E-Mail messages -- an important consideration since the Internet, started by the academic and scientific communities, is being embraced quickly by local and state governments.<sup>18</sup>

A LAN would support the sharing of scheduling information within and between departments. A number of employees indicated that they would like to be able share this information to help set meetings, schedule trips, etc.

Finally, if fiscal considerations dictate a stepped approach to the establishment of a LAN, the network could start by connecting the City Manager's office, the City Attorney's office, the department heads and other senior managers to a file server and then increasing the network's capacity as finances permit.

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<sup>18</sup> The Association of Bay Area Governments (ABAG) has established a "home page" on the Internet and has been actively encouraging its members to participate.

#### b. The Appropriate Computer Platform.

The more sophisticated programs being purchased by the City run on PC's (DOS based machines). An example is the CADD system which Public Works needs and the planning software that Community Development intends to install. However, the bulk of the City's personal computers are made by Apple. Thus, the higher level functions are moving away from the platform used by most employees. This trend is consistent with the overall personal computer marketplace. Most new software is being developed for the PC platform.

Therefore, while MCG is mindful that many City employees like the Macintosh platform because it is easy to use, the City should begin to replace its Mac's with PC's. While most computer network software supports both platforms, file sharing is much easier on a network if all users have PC's. Converting files from Mac to PC and back again involves time, and, in some cases, formatting can be lost. Finally, most network software is written to support PC file servers and it is very likely that any computer network installed for City-wide use will be based on PC servers. MCG recommends that the new MIS director undertake an analysis of this issue as one of his or her first tasks.

#### c. The Cost.

To establish a computer network throughout the City will involve significant costs. Each special purpose network, such as planning, or CADD may require its own server. However, the fiber network recommended later in this report contains some of the costs normally associated with the establishment of a wide area network. Thus, the City should only incur the normal costs associated with establishing a LAN with approximately 100 users connected to it.

While MCG is not a computer consultant, informal contacts with computer consultants indicated that a LAN with approximately 100 users would normally run between \$75,000 and \$125,000 to establish, not including the cost of application software and the PC's connected to the network.

#### d. Recommendations.

Therefore, MCG recommends that the City:

1. Begin planning for a City-wide local area computer network that will integrate the existing networks used within various City departments. This should be done as soon as possible.
2. Utilize the fiber link between City Hall and Public Works to extend the network between the two complexes. This will eliminate the need to lease private lines from PacBell or to use dial-up modems to transfer files and information between the two complexes and will permit the sharing of software like word processing and

spreadsheet programs.

3. Issue an RFP for the installation of LAN's covering City Hall and Public Works using the fiber link to create a virtual building.
4. Plan on integrating computer operations at other City facilities into the LAN as the sites are passed by the fiber ring.
5. As personal computers are replaced within the City, move the computer base to PC's whenever possible.
6. Implement universal E-mail as soon as the LAN is installed.

MCG recognizes that the above recommendations might be implemented over an extended period of time. Accordingly, the MIS director should reconsider each of them prior to implementation.

### *3. Groupware*

Closely linked to the establishment of an integrated computer network is the use of software that will support City functions and facilitate communications. While many specialized software programs are available and are certainly appropriate for specific applications, MCG is of the opinion that the City should create a groupware environment to provide the same "look and feel" for basic business functions to every computer connected to the network.

#### a. The Definition of Groupware.

Groupware is software that is used to move documents and information around the network. It is produced and sold by several vendors. The most widely used groupware at the present time is Lotus Notes®. Groupware acts as an electronic "in box/out box" system that can be programmed to send documents to the correct addressee automatically. For instance, the software can be programmed to send a monthly financial statement for the Community Development Department to the department head and the City Manager. The same basic distribution design could be programmed for each department.

Another aspect of a good groupware program is that security is very high. A sensitive document which is sent from one "desk" to another can be protected against unauthorized interception. The level of security in Lotus Notes is so high that the CIA uses it to send information throughout the agency and many large corporations use it for their purchasing system.

Groupware is often used for form filling and form distribution. An existing business form can be copied in the groupware and then filled out on a computer using the software. A request for capital spending, for instance, can be filled out by the party initiating the request and then sent automatically to each manager who is supposed to review and approve the request. If the request



receives all the necessary electronic approvals, it moves automatically to the Finance Department for action. If a manager in the chain disapproves, however, the request is sent back to the initiator with an explanation. Milpitas could use this functionality to manage and speed up the purchasing process.

Groupware is used by many companies to edit shared documents. Lotus Notes is perhaps the best software at the moment in this regard, although several other companies are working on competitive products. Notes keeps track of every copy of a shared document and “replicates” any authorized changes in the document in all copies as soon as the change is made. Thus, there cannot be two versions of the same document on the network (unless an earlier version is specially saved to preserve it). A good example of this application for Milpitas is the council agenda. Notes could be used to edit draft agenda items “on the fly” before the final agenda is printed.

Importantly, groupware can be integrated with E-Mail to provide sophisticated mail functions and to automate the distribution of E-Mail messages, if desired. During the internal needs assessment, many City employees expressed a desire to use E-Mail to speed distribution of routine messages throughout the City.

#### b. Implementing a Groupware Environment.

Groupware is usually sold through a vendor that specializes in setting up the basic application modules for the user. While it is not recommended that a novice programmer design and write the modules, maintenance and minor modifications are often done in-house by the user. Thus, if Milpitas implemented a groupware environment, it would probably hire a software firm to write the basic modules and train several City employees in routine maintenance. It should be noted that writing applications for Notes or similar groupware software is not as complex or expensive as writing other software programs.

A well-designed groupware environment will accomplish several things. First, it will speed up repetitive paper processes. This will not only improve efficiency, it will improve the work environment for employees. Second, groupware can provide additional, internal control over important processes. Using groupware for purchasing is an example. Not only will the software assure that proper distribution of purchase orders is achieved, it will automatically retain a record of approvals, disapprovals and comments by each person in the authorization stream. Retracing the path followed by a particular PO is very simple in a well-designed groupware application. Third, it will provide a shared computer environment for the City’s basic administrative functions. This will encourage the use of the software and, again, improve the working environment for employees.

c. The Cost.

The software cost for Lotus Notes is approximately \$175 per computer and \$500 for a development copy of the software. The real cost lies in the development of the application modules and can be as little as \$25,000 for a simple E-Mail system to several hundred thousand dollars for an extensive system with integrated imaging.

The City should issue an RFI and elicit software design proposals and, of course, cost estimates.

d. Recommendations.

MCG recommends that the MIS director:

1. Install a local area network to link the City's computers.
2. Appoint a committee composed of representatives from each department to study groupware. This committee should interview groupware vendors and visit businesses and/or municipalities that are using groupware so that a good understanding of the software and its capabilities (and weaknesses) is achieved. In the alternative, an expert consultant could be hired to work with employee representatives to design a groupware system.
3. Require the committee to recommend specific groupware applications for each department and for the City as a whole. If multiple applications are suggested, they should be prioritized.
4. Issue an RFI based on the committee's work and solicit design proposals and cost estimates for each module.
5. Based on the RFI, decide the extent of implementation and the timetable to be followed for implementation and training.
6. Issue an RFP based on the decisions made in Step No. 4.

## B. STAFFING CONSIDERATIONS

The City should establish its own Management Information Services ("MIS") Unit. The City has used BRC to provide MIS-type services over the last several years, but MCG believes the responsibility for overseeing computer and telephone operations belongs in-house. In many ways, the efficient and accurate distribution of information is as important to the City's basic functions as safe streets or well-maintained roadways. While the City often brings in experts to assist it in handling complex issues, it relies on its own resources to maintain essential services. MCG submits that in an information age, the health, safety and welfare of the City's information should be assured by the City's own employees.

### *1. Establishment of an MIS Unit.*

While it is obviously difficult to recommend the establishment of a new unit in a time of fiscal restraint, MCG must, nevertheless, recommend that the City use new employees to oversee computer, telephone and related functions. As the complexity and breadth of the City's computer, voice and video networks develop, the size of this unit may grow, but initially, it should be composed of two people.

The first new position should be an experienced MIS officer who can oversee the BRC contract and help the City develop its computer and telephone resources. The hiring of such an individual has been the topic of discussion prior to the issuance of this report and presumably will go forward in the near future. This person should be a fairly high-level manager who has the knowledge and experience to monitor trends and new developments in the computer and telephone industries. This person should be able to participate in strategic and long-term planning.

The second person who should be hired is a network administrator. This person need not be a strategic planner, but should be an experienced network administrator, preferably with municipal experience. If the City implements the LAN recommended earlier in this discussion, it *must* have a full-time person to maintain the network software, do back-ups and train new employees on network use. In MCG's experience, this is a full-time job which is essential in a large LAN environment. In fact, if the LAN is installed and only one MIS person can be hired initially, MCG would recommend that a network administrator be hired.

### a. Responsibilities of the MIS Unit.

The MIS Unit would be responsible for maintaining and improving the City's computers and its telephone system. Thus, the MIS Unit would be responsible for overseeing BRC, or whoever is hired to operate the City's minicomputers. It would be responsible for maintaining and improving the LAN. New network software would be tested and installed by the MIS Unit before it was released for use on the network. Training of new employees, or training of all employees when new software is installed would be the responsibility of the MIS Unit.



The MIS Unit would also be responsible for overseeing moves, adds and changes ("MAC's") in the telephone system. In many companies, MAC's are done by members of the administrative staff and it is likely that the City may delegate this job to one or more staff members. Nevertheless, overseeing the prompt and accurate completion of MAC's, and training staff members to do MAC's logically should be the responsibility of the MIS Unit.

The MIS Unit, and particularly the network administrator, could also perform "first aid" on a City-owned fiber network, if necessary. Network outages caused by a fiber failure are statistically very rare<sup>19</sup> and the new optical electronic equipment which would be used in a City-owned fiber network is very similar in design to modern PC's. The "box" where the fiber goes in and computer, video and telephone wires come out, contains one or more power supplies, a motherboard (or "backplane") and cards which plug into the motherboard to handle telephone, data, video, etc. In design and, in many ways, in function, it looks a lot like some of the equipment used to run a LAN. The new equipment also contains its own network management software which will diagnose problems and help the technician effect repairs. When electronic failures occur, it is often one of the cards, or one of the power supplies which fail and these can be repaired quickly if a small inventory of spare parts is maintained by the City. In addition, if the City decides to build its own fiber network, it should contract with an outside engineering firm to undertake modifications and major repairs.

#### b. The Cost.

MIS directors are considered senior staff by most cities and, thus, earn senior staff level salaries. An experienced MIS director will command a salary of \$60,000 or more.

Network administrators are considered to be senior support staff by most companies that operate LAN's. An experienced network administrator will command a salary of \$45,000 or more.

The MIS director will be performing job functions now performed by the BRC staff and, logically, his or her salary should be offset by a reduction in the contract price to match the transfer of responsibilities. The network administrator, however, would be a new position and there appears to be no BRC position that matches it. Therefore, the salary and benefits paid to the network administrator may constitute a new expense for the City.

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<sup>19</sup> MCG has developed a model which predicts the reliability of hybrid fiber coax networks based on the design of an individual system. Moreover, David Large, an MCG principal, is a member of the National Reliability Council, which was created by Congress to study the reliability of the nation's telephone network. The NRC, among others, has determined that a huge percentage of fiber cable failures are caused by physical cuts, usually by a construction company that digs through a right of way without checking on cables and pipes under the ground. However, through all causes, the probability of a fiber failure is generally estimated to be 0.06% in any one year.

## *2. Other, New Responsibilities.*

It is submitted that the City needs to vest new responsibilities in its existing staff to perform two new job functions. The first new function is the marketing of the City's excess telecommunications capacity. The need for this function has already arisen because of the decision to install two 3" conduits down McCarthy Street on the west side. It is believed that MFS has an interest in laying fiber down McCarthy and the City should market its excess conduit capacity to MFS immediately. The person(s) responsible for this function should have an interest in the business community and should have some experience negotiating business terms. The Public Information Office, with support from the engineers in Public Works, should be involved in the effort to market the City's telecommunications facilities.

The second new job function involves the development and marketing of the new public information resources established by the City. A major purpose for implementing new telephone and computer interfaces would be to detour a portion of routine public inquiries into an automated process, thus freeing staff time. However, it is unlikely that these new processes will work effectively if their availability and ease of use is not widely known. The City should undertake an aggressive public information campaign to make certain that the investment made in these new resources achieves the desired results as they relate to the internal and external plans. Logically, the Public Information Office should be involved in this process.

## C. OBSERVATIONS BY DEPARTMENT

The information gathered during the internal needs assessment should be extremely useful to the department heads. The City's employees "on the front line" had many good ideas about ways to improve their productivity and job satisfaction. A complete review of Exhibit F is highly recommended. As a result of its participation in the process, MCG has several observations, colored by the telecommunications backgrounds of the MCG principals, which may also be useful to the City. These observations have not been weighed against budgetary considerations. They are offered to stimulate discussion within the departments. No effort has been made to discuss every idea or concept raised by employees.

### *1. City Clerk's Office.*

Since the Clerk's Office faces recurring requests for certain portions of the City's ordinances, barking dogs, RV parking, etc., it would seem prudent to consider establishing an Internet Web site (a Milpitas "Home Page"). A Web site could be used for many purposes, some of which are discussed below, and it would be an efficient way to disseminate popular ordinance sections on the "net" for people to review and download. The general public survey indicated that almost half of the respondents have personal computers at home. This is significantly above the national average and the City should take advantage of the plethora of home computers by placing as much routine information as possible on the Internet.<sup>20</sup> MCG recommends that the City establish its own "Home Page" on the Internet.

The Clerk's office is heavily involved in the preparation of the agenda's for council meetings. Several people mentioned that creating and editing a council agenda required carrying paper back and forth between word processing and the department heads. Implementation of a LAN and groupware would make this process far less time consuming for the City's most senior managers.

### *2. Fire Department.*

This study specifically did not include the operation of the City's 911 service, but several people commented on the service nevertheless -- particularly on the computer aided dispatch system ("CAD"). The CAD system presently is used to dispatch fire and police units, but it is not used to dispatch Public Work's emergency repair crews. Public Works runs its own dispatch system and, as a result, develops its own case numbers for responses that may involve all the City's emergency services. It seems logical to fold the PW dispatch system into the CAD system and to develop a uniform case numbering system. Public Works uses its two-way radios to handle a lot of routine maintenance functions and these could continue to be handled "off" the CAD system, but the ability to communicate directly with Public Works vehicles through the CAD system would be very useful

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<sup>20</sup> In addition, a large number of persons have access to a computer at work and could access a City Web site from work if necessary. One vendor recently issued a software package useful for designing and maintaining an Internet home page for \$149 (retail).



in an emergency.

The Fire Department needs to connect its fire houses so that video training can be done without forcing the units to move their personnel (and equipment) to Fire House No. 1 for training -- thus affecting response time during training sessions. The department planned to purchase a microwave system for the video connections, an expensive and bandwidth limited way of connecting the fire houses. At MCG's suggestion, the Fire Department discussed their needs with South Bay CableVision and the cable company has made a preliminary commitment to use some of its excess fiber capacity to connect three of the four fire houses for video training purposes. Fire House No. 4, located on Barber Road, currently is not passed by cable. Therefore, it is possible that a microwave link from Fire House No. 1 to Fire House No. 4 may prove necessary until cable is run along Barber Road.<sup>21</sup> Eventually, the fiber ring recommended herein can be used to provide interactive video training between all the fire houses (at the same time if desired).

One respondent noted that some businesses could conduct their own fire inspections if the appropriate computer software was developed. If the City established a Web site on the Internet as discussed earlier, it is possible that some businesses may be able to perform a self-inspection and use the Internet to file the results with the department. The business survey indicated that the vast majority of businesses of all sizes have computers and modems.

It was also mentioned that there is a need to establish a better way of coordinating the activities of the hazmat and fire inspectors. The City recently entered into an agreement with Metricom to mount small data transceivers on City light poles. As a result, the City received a number of portable data modems which could be used in conjunction with personal computers to share scheduling information among inspectors.

The department has decided not to install mobile computer terminals in fire trucks for various reasons, but it was mentioned that the ability to receive information on the storage of hazardous materials at a fire scene would be useful. This could be done using an inexpensive portable PC and one of Metricom's radio modems.

The EOC also has the need to do remote video training because of the difficulty in assembling senior managers at the EOC for training. Individual training sessions could be conducted at City Hall and at other locations if the fiber ring is constructed and video capability is added to key locations.

### *3. Finance Department*

The implementation of a well-designed groupware module on purchasing would not only speed up the paper work process immensely, it would provide an audit trail for each spending request.

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<sup>21</sup> The City's cable franchise generally requires the cable company to connect City facilities to the cable system. Thus, it is presumed that the cable company will connect Fire House No. 4 to the system in the future

The Finance Department would like to be able to access information on stocks and bonds electronically. The present method used by the department was described as too slow in today's fast moving markets. The implementation of a LAN with a communication gateway would permit the department to connect at the fastest speeds permitted by the public telephone network and obtain stock and bond information from a number of sources. The Internet offers connectivity, for instance, to Edgar ( a software program), which provides next day access to all public documents filed with the SEC.

The department would like to issue business licenses electronically whenever possible. As noted earlier, the business survey revealed that most businesses in Milpitas, large and small, have a computer and a modem. Coincidentally, a number of the largest computer companies have joined to set safeguards and standards for the movement of money on the Internet. The protocol should be implemented within the next six to twelve months. Once available, businesses could send their payments to the City electronically and business licenses could be sent back by modem. This could reduce the labor for issuing a license significantly.

#### *4. Economic Development.*

The department would like a fast way to send information on the City to interested companies. One way to do that would be to put a basic package of information on Milpitas on the Internet. Interested companies could simply download the information from the City's Web site.

The City should consider making its next bi-annual Municipal Services Appraisal available on a computer disk in both Lotus 123 and Excel formats. Respondents could complete the form using their computers and return the disk by mail, or modem the file back to the City. Compiling the responses to the survey would be much easier, even if some of the responses were in written form.

#### *5. Public Works*

Public Works employees do a number of repetitive, labor intensive tasks which could be automated using off-the-shelf software which could be made available to all users on a LAN. This includes the manual entry of water pressures, the sending of routine letters to commercial water customers on backflow valve tests and the collecting of information on solid waste disposal by businesses. A good LAN administrator could help the department set up templates and macros to handle these routine and repetitive tasks.

The SCADA project, which is housed in the office building in the Public Yard, is under development and is included in the City's five year plan. A fiber network could be used to carry information to and from the SCADA control room assuming SCADA will recognize standard data protocols because there is existing conduit which connects the Yard building to the Public Works building.

The engineering division is presently investigating computer aided drawing and design



software to be used for building City base maps. This software could also be used by Fire, Police, Community Development and others to build special purpose maps based on the same base map. The City should proceed with this process as quickly as possible. In addition, the City could provide electronic base maps to developers and should require developers to submit plans electronically so they can be integrated into the City's data base once approved.<sup>22</sup>

The ability to control simple processes remotely was also mentioned by several people. The ability to start and stop pumps at the reservoirs, the ability to turn off lights at recreational sites and the ability to turn median strip sprinklers on and off are examples. It is possible that some of these functions could be controlled by simple devices connected to the fiber ring once the ring is installed.

Telemetry, like water volumes and pressures, could be transmitted over the ring from remote sites. In addition, alarm signals for heat, intrusion, movement, etc. could be carried on the network. It was suggested, for example, that remote sensors be installed on the City's gasoline tanks to monitor levels. Not only would this assure timely refilling, such sensors could detect a leak in the tank.

Video could also be transmitted over the ring. Surveillance cameras could be use for security at connected sites. Cameras could monitor traffic flow on major streets for traffic light control and safety.

#### *6. Staff and Administrative Services.*

The City uses keys to control access to its facilities. It was reported that key sets have been issued and not recovered from prior employees (or have been lost by present employees). One person suggested that the City go to electronic locks controlled by plastic ID cards issued to City employees. This suggestion is excellent because each card could be encoded with each "lock" it was authorized to open. Moreover, when a card is lost, stolen or otherwise leaves the system, the card itself can be de-authorized, thus preserving security. Once the fiber ring is connected to all major City facilities, the City should consider moving to electronic access for most or all locks in the City.

Getting City vehicles into the Yard for maintenance has been a problem at times. If the City implements a LAN with E-Mail, electronic messages could be sent requesting that the employee bring the vehicle in for service. Unlike the existing voice mail system, which apparently is erratic at times, the delivery and reading of E-Mail messages can be verified on many systems, making it difficult to avoid bothersome tasks like giving up your City vehicle for a day. Groupware could also be used to notify a driver of the need for vehicle service and could display available appointment times which could be selected by the driver as part of the reply back to vehicle maintenance.

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<sup>22</sup> Several individuals involved in the planning process indicated that paper copies of plans are preferred for the review process. That preference, which is logical, does not preclude the usefulness of an electronic copy of the plan, particularly the final and approved plan.



The use of a LAN by word processing would significantly reduce the down time of the word processing system. Presently, word processing uses a small Apple network which is becoming more unreliable as time passes. This division should be integrated into a full LAN. Moreover, the word processing output could be sent, via the network, to the printing and copying center in the basement of City Hall where, with compatible equipment, items could be printed for wide distribution (agendas, for example) automatically.

## *7. Recreation and Community Services.*

Like the Fire Department, Recreation and Community Services has actively upgraded its personal computer system over time (and by itself). It has installed a computer reservation system, but cannot integrate remote sites into the system, which is based at the Community Center. The interconnection of many of these sites by the fiber ring, together with the integration of the computer and phone systems using the ring, should make the reservation system more efficient and much easier for the public to use.

Recreation and Community Services cannot create mailing labels using any of the data bases maintained on the minicomputer system at Public Works. The ability to use an existing data base to conduct targeted marketing campaigns would be very useful. This is done routinely by businesses that use a LAN to access a large data base stored on a minicomputer (like the Sequent machines presently used by the City). Although less functional, HS may be able to use a relational data base program, like dBase or Paradox, to produce labels from the customer data base created by the reservation system, depending on the amount of information collected by the reservation system.

HS could also use the City's Web site to distribute activity schedules and class information. It would also be possible to allow a citizen to use the Web site to reserve a City facility (like a park) or reserve a position in an upcoming class.

## *8. Police Department*

The Police Department would like to connect the Great Mall substation with the main station located in the Public Works building. This could be done using the fiber ring proposed herein. The ring will pass along the north edge of the Great Mall.

The department has a collection of videos on bicycle safety and similar subjects that could be distributed to the public in a more efficient manner. The department could use the City channel on the cable system to do this. It could also use the City's Web site to list the titles available and provide information on borrowing a tape.

Presently, police officers record most of their field reports on audio tape. This tape is collected once or twice a day and physically carried to City Hall for transcribing by word processing. The use of audio recorders is considered extremely useful to the officers and, therefore, should continue. However, as the technology improves, it is likely that the cost of digital voice recorders

will come down in price. As this occurs, the City should consider converting the analog field reports to a digital format for transcription by the word processing staff. The written transcription could be sent back as a secured word processing document on the LAN for review and approval at police headquarters.

### *9. Community Development.*

Several departments are involved in the planning process and the use of groupware to control the paper flow and collect comments about a plan is a logical application. In fact, in routine proceedings, the departments could review the document and sign off electronically without meeting in person. In addition, groupware can display the status of any document in the system at any time. Thus, the ability to do quick status checks would also improve. This functionality may be provided by software written specifically for the planning process, but if not, groupware should be considered as an adjunct to a planning software package.

The installation of a LAN would permit employees of the department to work at home. Several persons indicated that the ability to work at home would be desirable.

### *10. City-Wide Observations*

If the City implements the proposals discussed herein, there will be a need to establish a training program to teach new employees how to use the phone system and computer network. Moreover, there should be an on-going effort to maintain the skills of existing employees. This training should become a regular part of each employee's continuing education program.

Security issues will be important to network operation. A good network administrator can establish and maintain tight security provisions, which is one reason why the position is so important. However, sloppy practices by network users can lead to stolen passwords and unauthorized access. Part of the continuing education program should focus on security issues.

As the City's information moves from a paper platform to an electronic one, record retention and destruction become important issues. A building volume of paper records often leads to the destruction of old records to open up space for newer ones. In the case of electronic storage, hard disk space can often impose the same physical stimulus to file destruction. However, floppy disks are often saved for years and each disk can contain one or more storage boxes of documents if the contents were printed out. Policies need to be established to determine when electronic files should be destroyed. The City Attorney's Office has already addressed this issue on occasion and the problem will surely grow.

Finally, policies need to be established governing the release of electronic files to the public. Over time, the general public may be granted access to certain portions of the City's electronic files for status checks, retrieval of ordinances, reviewing of council agendas, etc. Keeping confidential records safe from computer theft is an issue which the City must face *before* a problem arises.

## D. INFRASTRUCTURE IMPROVEMENTS

As indicated earlier in this report, MCG is of the opinion that the City should construct its own fiber network to carry information to and from each major municipal facility. The network should be constructed over time to take advantage of the opportunity to use proposed public works projects to install conduit to carry the fiber cable. The City can realize substantial savings by timing the fiber project to match the installation of conduit for traffic control and to match the excavations that will be done to install future extensions of the recycled water distribution system.

The phases of the project were summarized in Section VIII, *supra* and are discussed in detail below.

### *a. The Benefits*

The installation of a fiber optic cable will provide the City with:

1. An independent, City-owned telecommunications backbone between the two principal buildings used by the City. The use of a City-owned backbone will essentially fix a significant portion of the City's telecommunication costs over the life of the network.
2. Route diversity from PacBell's lines in case of a failure of the public phone network due to fire, earthquake or other reason. "Route diversity" refers to the fact that the City's fiber will not be installed in the same physical conduit as PacBell's lines. At present, the City leases both Centrex and private data lines from PacBell and there is no guarantee that these lines run via different physical pathways. Thus, it is possible that a cable cut could interrupt both Centrex and private line service. Both buildings are served from the same Central Office and it is likely that both voice and data streams are packaged digitally and are transmitted through lines running along the same path.
3. The infrastructure to support the interconnection of PBX's located in each building, thus creating a "virtual" building where all phone users will share voice mail, call forwarding and the other features found in modern PBX systems.
4. The potential to transmit VCR quality video (or better) from building to building for purposes of security monitoring, training, etc.
5. The ability to transmit high speed data between the buildings without utilizing the public telephone network. This will permit the interconnection of local area computer networks in the two buildings without suffering the data speed restrictions imposed by the public, switched network.



6. The ability to transmit voice, data and video over a secure, private fiber facility which will be highly resistant to tampering and unauthorized interception.

*b. The Approach*

In exploring options, Media Connections Group was guided by a need to find lower cost options for current needs, while building a "platform" which would allow expansion to future needs economically. Also, we were concerned with the need to provide for redundancy where possible, so that critical communications could not be interrupted by such factors as natural disaster, sabotage or accidental cable cut.

As noted earlier, the highest volume of both data and telephone traffic internal to the City is carried between the City Hall complex and Public Works. We are therefore recommending that the City build a fiber-optic link between those facilities as the first phase of a complete city-owned communications network. The construction of the complete network can be completed in phases until it include all facilities with communications requirements. Equally important, with advance planning, it can be configured to form a "self-healing ring" whose functionality will not be deterred by a cable cut at any one point along the ring.

*c. The Electronics*

As described in detail below, in addition to the investment in the fiber optic cable itself, the City will need to install optical transmitting and receiving equipment in both buildings. The optical transmitting equipment will "package" digital signals into a standardized transmission format and will both digitize and package analog signals for transmission. At the receiving end, complementary equipment will convert the signals back to their native format and route them to the appropriate receiver, be it telephone equipment, a computer network, a video receiver, etc.

This equipment was essentially built only for telephone companies in years past and thus was extremely expensive. However, a number of manufacturers now produce optical electronics in modular designs. MCG has discussed the installation of this type of equipment with several vendors and, as the discussion below presents in detail, the cost is now low enough to justify the purchase and installation of this type of equipment by private telecommunication users, like the City of Milpitas.

In the process of researching the available options for terminal equipment for such a network, MCG investigated, in some depth, the product line offered by a Bay Area company: Fibronics International, Inc. The following description of available options, capabilities and pricing is based on their product line and is intended to *illustrate* what is available and allow budgetary pricing. MCG is not making a recommendation as to which supplier the City should choose for this equipment and, in fact, recommends that the City issue an RFP when it is ready to proceed with detailed design on the network. Among competitors to Fibronics are such companies as Cisco, Cabletron, RACAL and 3COM.

#### d. An Example of Terminal Equipment: Fibronics

In a point-to-point implementation, the fiber cable terminates at each end in a rack-mounted "Gigahub". The Gigahub includes a common power supply (redundant supplies can be used for higher reliability), an interface to the fibers on one end, and interfaces to various user circuits on the other end. Two fibers are used between the hubs, one carrying information in each direction.

##### 1. The Fiber Network Side

More than two hubs can be connected in series, with the same data stream shared among the users and having the capability of transmitting information among all the hub locations simultaneously, as shown in Figure 9. Should the communications volume exceed the capability of a single fiber-optic transceiver, the hub will support multiple fiber-optic interfaces. Two fibers must be available in the cable for each circuit, however.

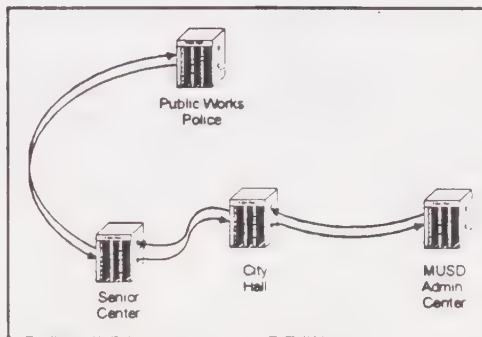


Figure 9

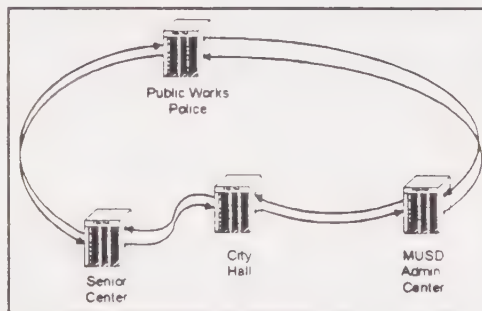


Figure 10

The highest reliability and immunity from interruption results when the interconnecting fiber cable is constructed so as to form a complete "ring" connecting a number of hub locations. If each hub is equipped with two fiber-optic transceivers, one communicating "clockwise" around the ring and one communicating "counterclockwise" around the ring, then no single failure of either the cable or a fiber-optic transceiver will result in a communications outage. This configuration is shown schematically in Figure 10.

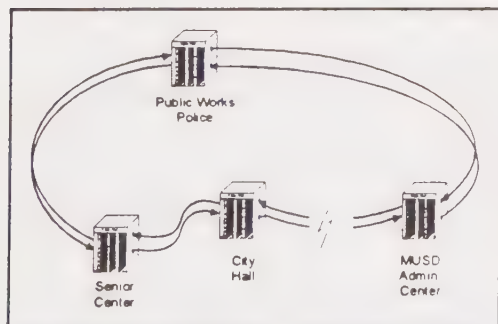


Figure 11

If the cable between MUSD and City Hall were cut, for instance, the traffic between those locations would simply travel "the long way" around the ring. An electronics failure would result in traffic moving on the unaffected fiber. Figure 11 depicts the "fail safe" nature of a fiber ring.

The Fibronics equipment currently supports two data protocols (standards for data transportation and reception) on the network side: a proprietary protocol which supports user-side T1<sup>23</sup> circuits, off-premise telephone

<sup>23</sup> "T1" is a data circuit commonly used to transmit 24 telephone voice conversations simultaneously. Large PBX's (private telephone switches) may provide T1 ports instead of individual trunk connections for network interconnection or connection to other PBX's. Fractional T1s contain fewer voice circuits.

extensions, and off-premise computer terminals, such as IBM 3270 and AS 400.<sup>24</sup> The second protocol, known as FDDI, supports such user-side data circuits as Ethernet, TCP/IP and token ring.<sup>25</sup> When it is necessary to transmit both types of traffic between locations, separate fibers and fiber-optic transceivers are required. The manufacturer expects to support ATM<sup>26</sup> trunking by early 1996.

## 2. The User Side

Cards are available which plug into the Hub and provide an interface between the high-speed data in the network and individual applications.<sup>27</sup> Among available cards that interface with Fibronics' proprietary protocol are:

- Full or fractional T1 data circuits
- 16 line analog voice circuits for use directly with telephones or as PBX trunk connections
- RS232 data circuits, for remote modems or computer terminals which use this protocol
- IBM AS/400 or 3270 or Wang VS remote computer terminals

Cards which can share one FDDI data link include ethernet, token ring, FDDI, fast Ethernet, and ATM. The product line also includes various components which can be used to create or interconnect various types of LANs within buildings, if desired. Cards with 8, 12 or 24 Ethernet ports are available, for instance.

## 3. Special Video Capabilities

While the basic Gigahub will support video, Fibronics also offers a video hub that is designed for remote video surveillance or video conferencing, such as Milpitas contemplates needing at critical traffic intersections. The Mavix product includes inputs for camera and microphone, digitizes the information and shares use of the FDDI trunking system to transmit it to other locations up to 40 miles away. The box also has inputs and outputs for sensors and controls and simultaneously supports RS-232 data circuits for camera control. Up to 50 of these video hubs can be supported on one FDDI ring.

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<sup>24</sup> These are data protocols used by some types of computer terminals to talk to host computers.

<sup>25</sup> These are protocols used in various types of Local Area Networks (LANs).

<sup>26</sup> Asynchronous Transfer Mode, or ATM, has the potential for supporting all of the services required on a single data stream and also for supporting very high data rates. In the future it may well obsolete many of the existing data protocols.

<sup>27</sup> A "card" as used in this discussion is similar to a card used in a personal computer. It is a circuit board with solid state components mounted on it designed to perform a specific function when inserted into a fiber optic hub cabinet. Some "cards" send and receive telephone conversations. Others send and receive high speed computer data or video.



A feature of the Fibronics product line is that Simple Network Management Protocol (SNMP) is supported throughout all modules, allowing a remote terminal to monitor and control the entire network.

This description of one manufacturer's capabilities illustrates how relatively few fibers, appropriately routed can support all the City's needs for PBX interconnect, off-premises extensions, LAN interconnect, video training distribution, remote traffic monitoring and various data circuits. Since manufacturers will vary in the depth of their product lines and local support capabilities, MCG recommends that the City invite a variety of vendors to study the City's needs in detail and submit detailed proposals. The City can then evaluate these on the basis of completeness, initial capital outlay, upgradeability and other factors.

## PHASE I

### CONNECTING CITY HALL AND PUBLIC WORKS

#### *a. The Concept*

It is recommended that the City lay fiber optic cable between City Hall and the Public Works/Police building located approximately one mile north along North Milpitas Boulevard. These two buildings generate most of the voice and data traffic in the City and have obvious potential for the use of video services. Moreover, as discussed earlier, the Public Works Yard and Fire House No. 3 are connected by conduit to the Public Works building, and the Library and the Community Center are located within the same property parcel as City Hall and could be connected to City Hall by conduit for a modest additional investment.

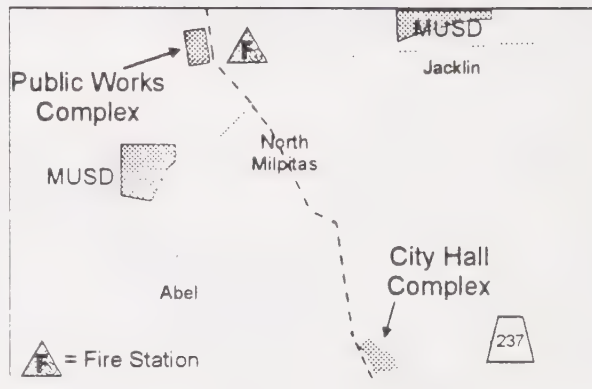


Figure 12

#### *b. The Fiber Interconnection: Use of Existing Facilities*

The route to be taken between City Hall and Public Works is depicted in Figure 12. Exhibit L details in a larger scale and in color which existing facilities may be used to complete the route. First, existing traffic control conduit runs from the Public Works building south along North Milpitas Boulevard to the intersection with Abel. Another conduit runs along North Milpitas Boulevard from City Hall and stops one block south of the intersection with Abel. The red conduit (traffic control) running from City Hall north along Milpitas Boulevard is empty and could be used in Phase I for the fiber link between City Hall and Public Works. The traffic control conduit north of Jacklin, however, is currently occupied and the conduit is small, only 1½ inches in diameter. In order to use this conduit, it is likely that the traffic control cable must be pulled out of the conduit and re-installed, along with the fiber cable. CalTrans has issued a guideline on the desired amount of empty space for heat dissipation within a conduit. The volume occupied by the fiber cable will violate this requirement; however, fiber cable does not generate heat, radio frequency interference or electro-magnetic fields and it is hoped that it will be treated as empty space for purposes of CalTrans' recommendation. City engineers are currently investigating the potential use of the conduit.

In order to utilize the occupied conduit north of Abel, the City could install a small fiber sheath (approximately 3/8" in diameter) carrying twelve fibers. However, the conduit south of Abel will be part of the fiber ring proposed for Phase II. Therefore, it must carry at least 24 fibers and must be a standard sheath of ½". When this fiber cable is pulled through the empty conduit, the City should consider pulling the traffic control cable through at the same time. As discussed in Phase II,

this may be difficult depending on the size of the traffic control cable.

It will be necessary to install a connecting conduit along the "open" block of North Milpitas Boulevard, but this can be done using boring equipment in lieu of open trench construction. This conduit should be sized to take both traffic control and fiber cables to accommodate future needs.

If possible, the fiber run north of Abel should be made with a 1/2" sheath containing 24 fibers. If that proves too difficult, a smaller sheath (3/8" in diameter) carrying twelve optical fibers could be used. In either case, only two fibers will be used initially -- one in each direction. All voice, data and video traffic will be carried on these two (or four) active fibers. The other fibers in the sheath will be "dark" and will be available for future use and, of course, as spares in case of physical damage to an active fiber.

### *c. The Cost*

Assuming that the total project is completed in the first year, the City will invest \$70,854 in fiber optic cable and optical electronics.<sup>28</sup> If the existing traffic conduit cannot be used, MCG estimates that the construction costs for the fiber cable would be \$60,456 and the cost of electronics would be unchanged at \$50,790. Thus, if new conduit had to be used in lieu of existing conduit, the fiber interconnection would cost an estimated \$111,246.

This estimate includes the cost of a UPS and backup generator in City Hall to keep the phone switch and the hub running in the event of a power failure. It is assumed that the backup generator serving the Public Works building will handle the modest loads imposed by the new fiber and telephone equipment.

As discussed in detail earlier, if this phase is completed and is used to interconnect a PBX in Public Works to a PBX in City Hall, the City will realize substantial Centrex savings over the life of the telephone equipment which will offset the cost of this phase of the project.

### *d. Timing*

It is recommended that the first phase of the network be completed in the first year of the overall fiber project -- calendar year 1996. This will permit the City to interconnect LAN's in City Hall and Public Works as soon as possible and will also permit the switch to a new telephone system as soon as the current contract with PacBell will permit.

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<sup>28</sup> Estimates for fiber installation contained in this section do not include design or make ready costs. It is assumed that the fiber ring will be installed underground and further assumed that much of the design costs for the network will be included in other projects. Ancillary costs, like insurance, bond premiums, traffic control, etc. are not included on the assumption that the City will either not incur these costs or will provide the service during construction.



## PHASE II

### A SELF-HEALING INNER FIBER RING

The second phase of the project recommended by MCG involves the construction of a fiber ring around the downtown area of Milpitas. This ring will pass most significant City facilities and some of the facilities operated by the Milpitas Unified School District. A map showing the suggested route of the fiber ring is set forth Figure 13 below and in Exhibit M. In order to save costs, MCG has suggested that the City "piggy-back" the construction of the ring on public works projects undertaken for other reasons.

This approach has already begun. The City has decided to install two 3" conduits in the trench that will be opened for the Recycled water project in the next two years. The City also revised the plans for the Tasman Bridge project to include telecommunications conduit. When the City's plans became known, Pacific Bell agreed to pay the cost of installing four conduits and agreed to install two conduits for the City at their incremental cost. Not only did the City secure an important access path to the west side for its own use at minimal cost, but it is likely that one or more telecommunications companies will lease conduit space from the City in the future in order to cross I-880. The approach of controlling "choke points" or key crossings within the City's jurisdiction is an important component of a successful strategy for controlling access to the City's rights of way.

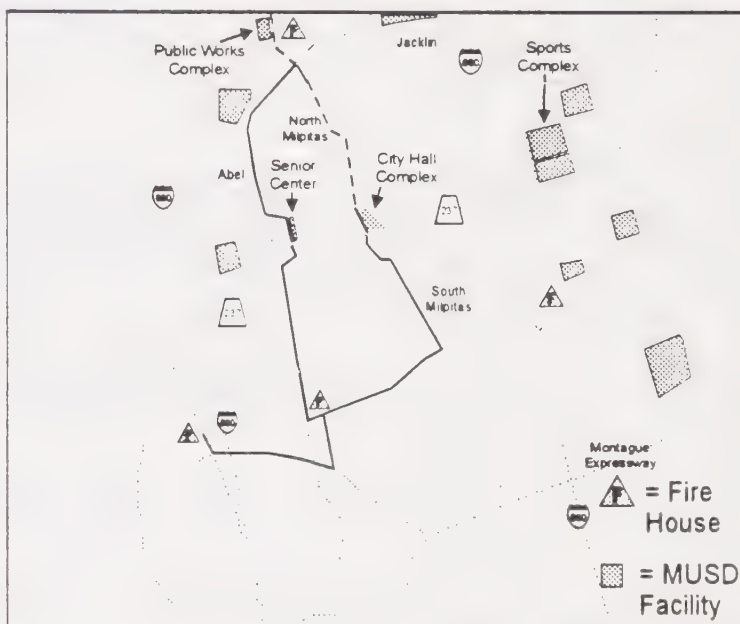


Figure 13

#### *a. The Concept*

A federal study, undertaken by the Network Reliability Council, a body established by Congress following several major failures in the AT&T long distance network, determined that a large percentage of failures in fiber optic networks was caused by cuts to the fiber lines by backhoes and similar types of equipment. In order to insure that communications carried over a fiber optic network is not interrupted, engineers have applied the "ring" concept, developed in the telephone industry, to hybrid fiber coax networks. Figure 13 shows how a ring might be constructed in Milpitas.

The electronics used to send information over a fiber ring is designed to reverse the direction of communications if the ring is cut or otherwise disrupted. Thus, no services are affected by a single cut. Figure 11 shows how communications would be routed around a cable cut in a typical fiber ring.

If Milpitas were to construct a fiber ring around the downtown area, it would gain a number of benefits:

- The fiber network would connect Fire House No. 1 (and the Fire Department administration offices) to City Hall and the Police Station located in the Public Works building. The Senior Citizens' Center would also be passed by the fiber ring. A "spur" of the ring will connect Fire House No. 4 to the ring as part of this phase.
- The construction of a fiber ring would permit the use of self-healing software and hardware to insure uninterrupted City communications in almost all circumstances.
- The fiber ring would provide "route diversity" from PacBell lines. Since the City would still be connected to the PacBell network at key locations, the public network could be used in case the fiber ring is severely damaged or destroyed.
- The fiber ring could be used to provide high speed connections between City computers.
- Confidential information, such as police field and arrest reports could be sent over the City's network without fear of unauthorized reception.
- A fiber ring could become a key resource to the Emergency Operations Center in case of damage to the public network during an emergency.
- The City could base its decisions on whether to add new services to its network (video surveillance cameras at City facilities, for instance) based solely on the cost of the terminal equipment because network costs would be fixed.
- The City could lease bandwidth to other governmental users, for library connections, for example, and could integrate services with MUSD, City and County facilities.
- The City could lease bandwidth to private users and derive revenue therefrom.

The fiber ring can be built very economically if existing conduit is utilized for portions of the ring and planned public works projects involving street openings are expanded to include installation of fiber and/or conduit.

#### *b. The Electronics*

As discussed in the Phase I portion of the plan, the electronic equipment used with the network is likely to become more sophisticated and cheaper as time passes. Thus, as the network is built over the next several years, the electronics portion of the network budget is likely to decrease while the functionality of the equipment will increase.

Electronic equipment used with fiber rings is manufactured and sold by many vendors including Fibronics, AT&T, Cisco, 3Com, Nortel and others.

#### *c. The Ring*

MCG estimates that a fiber ring passing most major City facilities will be a little under five miles in circumference (see Figure 13). The ring should carry a minimum of 24 fibers to assure that sufficient bandwidth and spare fibers are available for City use over the next ten years. Spare fibers will not only serve as backups should a fiber suffer catastrophic damage, they will permit individual fiber pairs to be dedicated to specific City locations. Each fire house could have a dedicated fiber pair, for instance, running from the dispatch center through the ring. Similarly, Fire House No. 1 could be connected directly to each of the other fire houses in a dedicated ring running within the main ring, or the main police station could be connected directly to a substation in the Great Mall with a dedicated fiber pair. The low cost of adding fibers to the ring at the time of construction (about a nickel a foot per fiber), has permitted network engineers to build-in high redundancy ratios without adding significant costs to the overall design. The City should take advantage of the economics and install at least four times the number of fibers that will be used initially to operate the network.

Exhibit M is color-coded to show existing and planned conduits which could be used to carry fiber cable. In some cases, the conduit is used presently to carry copper wires for traffic light control. In other cases, the conduit will be installed when the recycled water project is undertaken. With careful planning, the City may be able to utilize existing infrastructure to carry a significant portion of the fiber ring. The fiscal impact of using existing conduit is substantial, as will be discussed in detail below. The other factor supporting the use of existing facilities is time. The network could be constructed faster using existing conduits whenever possible.

An examination of Exhibit M shows how the ring could be constructed. From the nine o'clock position on the ring and moving counter-clockwise to the three o'clock position, the fiber cable can be carried in new conduit that will be installed within the next two years. The southern portion of the ring will run through conduits installed during the recycled water project (the yellow conduit). The southern portion of the western and eastern legs will use new traffic control conduit



which will be installed within the next year (the blue conduit). This conduit is being designed to have sufficient capacity to carry the fiber cable. Thus, the bottom half of the ring can clearly be placed in conduits that will: (a) be installed as part of a planned public works project (traffic control and recycled water); and (b) will be designed to have sufficient capacity for the fiber cable.

The upper half of the ring is more problematical, however. As discussed in Phase I, the red conduit (traffic control) running from City Hall north along Milpitas Boulevard is reportedly empty and, if so, will be used in Phase I for the fiber link between City Hall and Public Works. The traffic control conduit north of Jacklin, however, is currently occupied and the conduit is small, only 1½ inches in diameter. In order to use this conduit, it is likely that the traffic control cable must be pulled out of the conduit and re-installed, along with the fiber cable. Similarly, the northern portion of the western leg (from twelve o'clock to nine o'clock) could run through existing traffic control conduit. The main ring must carry at least 24 fibers and the sheath must thus be a standard ½" in diameter. There is no question whether the 1½" conduit running from the intersection of Jacklin/Abel and Milpitas Boulevard down to the new traffic control conduit to be installed under Calaveras (blue conduit on Exhibit M) can accommodate both cables. In terms of pure cross-section, Figure 14 (which is to scale) shows that the conduit is large enough, but in practical terms, the two cables may simply be too large to pull through.<sup>29</sup> This run is approximately one mile, or one-quarter of the ring. These issues need to be studied carefully.

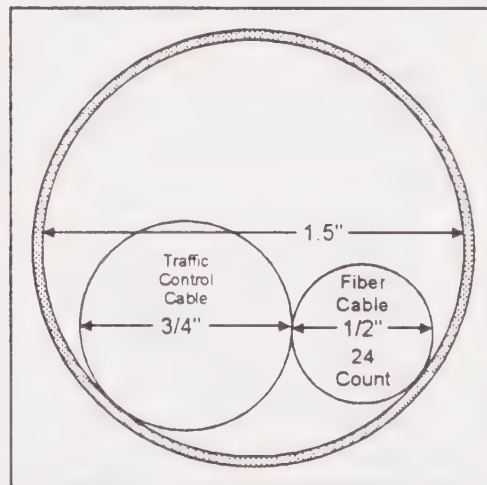


Figure 14

There is also a two block length of fiber which needs to be installed from the southwestern point of the ring, south to the Tasman Overpass conduit (which has already been installed). This short "leg" will connect the inner ring to the western ring which is recommended in Phase V. As in the case of the conduit along Abel, there is existing and occupied traffic control conduit which could be used for this purpose. It is believed that this conduit is also 1.5" in diameter.

Finally, there are two legs of the ring that must be constructed from scratch. The first is a two-block section of "future" traffic control conduit which runs two blocks south of City Hall along Milpitas Boulevard. This conduit may be installed, but it is not planned at present. Therefore, the network financial plan, discussed below, assumes that the City will install conduit along this two block section to complete the ring.

The second section which must be constructed is along Barber and would connect Fire House No. 4 to the Tasman Bridge conduit (which is already installed). If this is done, Fire House No. 4

<sup>29</sup> It is also possible that some new pull boxes will be needed if the fiber and traffic cable can be pulled through.

will be connected to the City's fiber ring. This will permit the interconnection of telephones and computers. With the addition of video equipment, the Fire Department could use the ring to transmit training videos to all four fire houses simultaneously once Phase III is completed. Interactive training could also be done.

Although not included in this phase, MCG recommends that the City ultimately connect the Public Works building to the ring using two different routes. The purpose of two routes is to insure continuity of service if one of the fiber runs is cut by accident. Route diversity could be achieved by simply running parallel fiber runs down both sides of North Milpitas Boulevard from the intersection of Jackson/Abel and North Milpitas. It could also be achieved by running a second connection through the neighborhood streets located above Jackson. The timing of this second route is not critical to the success of the overall plan because the statistical chance of a failure in the fiber is quite small. It should, nevertheless, be done when the opportunity presents itself.

#### *d. Cost of the Inner Ring*

Assuming that the City completes Phase I and connects City Hall and Public Works, MCG estimates that the cost of constructing the remaining four miles of the inner ring will run an estimated \$72,653 for the fiber and \$35,685 for the necessary electronics, for a total project cost of \$108,338. These figures assume that existing traffic control conduit can be used to carry the fiber cable down Abel Street. If new conduit must be installed along Abel, the cost of the project will increase to an estimated \$155,462.

If the estimated cost of the PBX equipment is added to the network costs, the City will invest approximately \$568,266 in the fiber ring and telephone equipment to service City Hall, Public Works, Fire House No. 1, Fire House No. 4 and the Senior Citizens' Center. If these estimates are netted against expected Centrex savings over the ten year life of the telephone equipment, the net present value cost to the City will be an estimated \$59,608.

If the existing traffic control conduit running along Abel cannot be used, the cost of the inner ring and telephone equipment is estimated to be \$655,782. If this investment is netted against the expected Centrex savings over ten years, the total project will result in a net present value cost to the City of an estimated \$139,654. As discussed earlier, the City's ability to realize the Centrex savings will depend on the existing contract between PacBell and the City, which is being reviewed by the City Attorney's Office.

The value of using existing conduit can also be estimated. MCG estimates that the fully loaded cost of installing the fiber network in new conduit would cost the City approximately \$376,664 (Phases I & II). This compares to the estimated cost of \$179,192 if existing conduit is used. The difference, \$197,472, represents a savings of 52% over the fully loaded cost for Phases I and II.

*e. Gateway to the West Side*

The short leg running south to the Tasman Bridge conduit is recommended for this phase because the City will be pulling fiber along one end of the leg to complete the inner ring and the same crew could efficiently handle the fiber pull. By pulling fiber through the existing conduit in the Tasman Overpass, the City can connect Fire House No. 4 to the network by installing one block of conduit and fiber. Only Fire House No. 2 would not be connected at the end of Phase II. Fire House No. 2 will be passed by Phase III, scheduled for the next year.

There is a second purpose for crossing I-880 in Phase II. Completing the Tasman crossing over I-880 will give the City a southern crossing to the West Side. The City approved a northern crossing near Bellew (along the water right of way) when it decided to install fiber conduit as part of the first phase of the recycled water project. Two crossings would allow the City to integrate a fiber ring on the West Side to the main ring proposed in this Master Plan and would provide the West Side with the same self-healing protection as will exist to the east of I-880. The west side ring is discussed in detail in Phase V, *infra*.

Finally, running fiber to the south will facilitate a future connection to the Elmwood Correctional Facility which could be useful to both the Police Department and the City Attorney's office.

*f. Timing*

MCG believes it is critical to the integrity, usefulness and durability of the internal fiber network proposed herein that Phases I and II be completed as soon as possible.

Construction on the recycled water project is presently scheduled to start in the third quarter of 1996 and the first phase should be completed before June, 1997. It is recommended that Phase II of the fiber network be completed as the water project conduit becomes available. Thus, MCG recommends that this phase be completed in calendar year 1997.



## PHASE III

### A SELF-HEALING OUTER FIBER RING

#### *a. The Concept*

The third phase of the fiber network recommended for the City involves the extension of the fiber ring to encompass the MUSD administrative offices and the Sports Center. Figure 15 shows the suggested path of the outer ring. It is estimated that this extension would entail approximately three miles of fiber cable. As can be seen in Figure 15, the southern leg of the inner ring would be extended to the east, just north of the Great Mall, pass under I-680, turn north and run past the MUSD complex and the Sports Center, and then turn west on Jacklin to connect to the inner ring at the intersection of Jacklin/Abel and Milpitas Boulevard.

Exhibit N shows that the outer ring is designed to run primarily through conduit which is proposed for a future extension of the recycled water project (the orange conduit on the map). Traffic conduit would be used to run the fiber along Jacklin. The first two blocks would involve the use of future traffic conduit (the green conduit) and the rest would involve the use of existing traffic control conduit (the red conduit).

#### *b. The Cost of the Outer Ring*

The outer ring would consist of at least 24 fibers in a 1/2" sheath. If existing conduit is used for this portion of the project, MCG estimates that at today's prices, the fiber would cost approximately \$79,992 to install. Electronics to connect Fire House No. 2 and the Sports Complex to the ring would cost an estimated \$23,790 for voice and data connections. The total project costs are thus an estimated \$103,782. The MUSD administrative offices would be passed by the ring in this phase and the District would need to spend a similar amount to connect each building to the ring for voice and data purposes. In all cases, internal wiring would be additional.

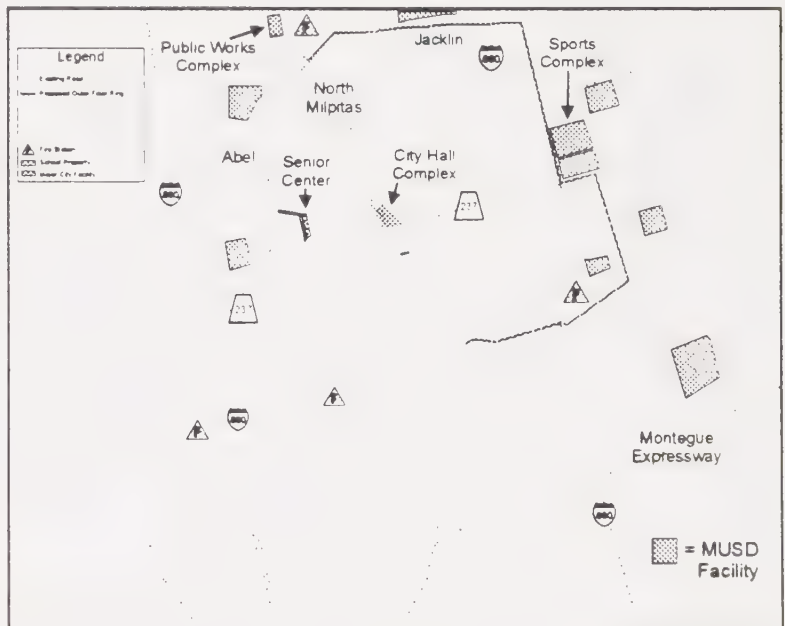


Figure 15

If the existing traffic conduit along Jacklin cannot be used for this project, MCG estimates that the cost of the fiber for the third phase would rise to \$118,437 at today's prices and labor rates. This

should be compared to a "fully loaded" estimate (all new conduit) of \$205,158. Therefore, in the most favorable case, the use of existing and proposed conduit will result in a savings of \$101,376, or 49.4%.

*c. The Timing*

The outer ring is designed to use conduit installed during the second phase of the recycled water project. The timing of the second phase of the water project is uncertain at this time, but is estimated to be three to five years by the engineers working on the project. MCG has assumed, for the purposes of this discussion, that the conduit needed to complete Phase III will be available in calendar year 1998. Thus, the financial model, used to calculate the net present value cost of the network, assumes that this phase is completed in year three of the overall project.

## PHASE IV

### EXTENSION OF THE OUTER FIBER RING

#### *a. The Concept*

The fourth phase of the fiber network involves the possible extension of the ring to the south as shown in Figure 16. At the southeastern point of the outer ring, fiber would be extended south along Yellowstone to pass a large MUSD complex.

Exhibit O shows that the fiber would utilize new conduit installed during a future phase of the recycled water project (the orange conduit), although it could also be installed in existing traffic control conduit which presently lies along the same route.

Completion of this phase, while not critical to the bulk of City communications, would place the City-owned fiber ring within one-half mile of virtually any location in the developed portions of the City east of I-680. It would also permit the MUSD to connect its major Internet access site to the fiber ring if it wished to do so.

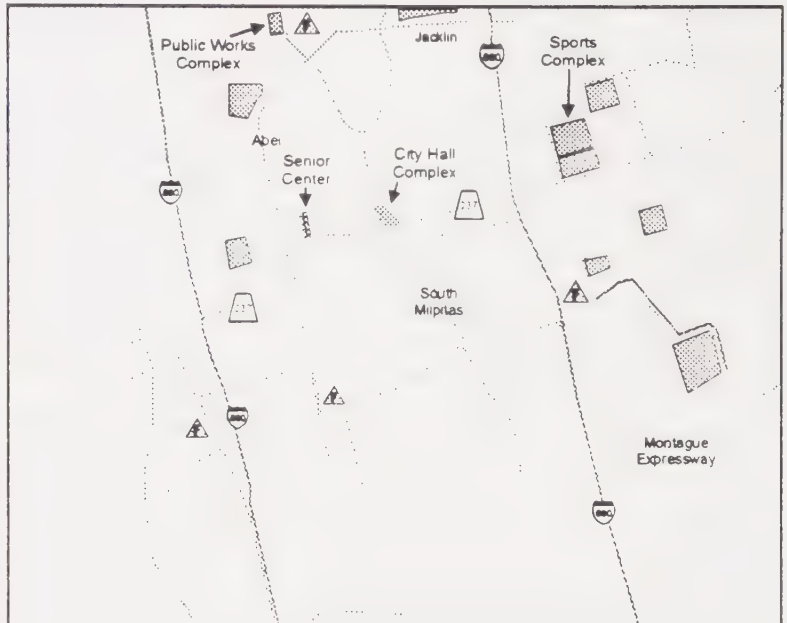


Figure 16

#### *b. The Cost*

It is estimated that this extension would entail the construction of 0.75 miles of fiber cable -- all of it through new conduit installed during the second phase of the recycled water project. Assuming that existing conduit is used for the project, MCG estimates that the cost of Phase IV would be \$11,682 at today's prices and labor rates (assuming a 24 fiber bundle). It is assumed that any electronics costs (to connect the MUSD facility to the network) would be borne by the school district.

If Phase IV were constructed with all new conduit, the estimated cost would be \$45,342. The use of existing conduit and conduit installed during other public works projects will thus save an estimated \$33,660, or 74% of the project's "fully loaded" cost.



*c. Timing*

This extension uses conduit planned for the second phase of the recycled water project. Thus, it could be done at the same time as Phase III. However, for purposes of the cost estimates, MCG has assumed it will be completed in the fourth year of the project, or in calendar year 1999.

## PHASE V

### COMPLETING THE WESTERN RING

In August, 1995, the City Council approved the installation of two 3" conduits in the first phase of the recycled water project. Part of this conduit has already been used for Phases II and III of the fiber ring project. However, the majority of the linear feet of conduit approved by the Council lies along Bellew and McCarthy Streets on the western side of the City. While there is only one major city facility located on the west side presently, Fire House No. 4, the conduit will run along an area where business development has occurred and is expected to occur in the future. The McCarthy Ranch mixed use project will be located on the west side, to the north of Route 237. Therefore, finishing the overall ring by including the west side will match the City's telecommunications foresight with the area of greatest, projected future growth.

#### *a. The Concept*

Figure 17 and Exhibit P depict the western ring. Except for several blocks along Barber, the ring would use the conduit installed during the first phase of the recycled water project. The ring would connect with the rest of the fiber ring by crossing I-880 in two locations: the first runs along Bellew (the recycled water route); the second runs along the Tasman Bridge. The conduit in the Tasman Bridge was installed during the bridge's construction and is of sufficient size. If Phase II is completed, the southern fiber crossing will have been done and the ring will take very little time to complete given the existence of adequate conduit over almost the entire route. Although the map shows the installation of only the fiber needed to form a ring on the western side, existing (and dedicated) conduit along McCarthy would permit the installation of fiber all the way to its southern extreme.

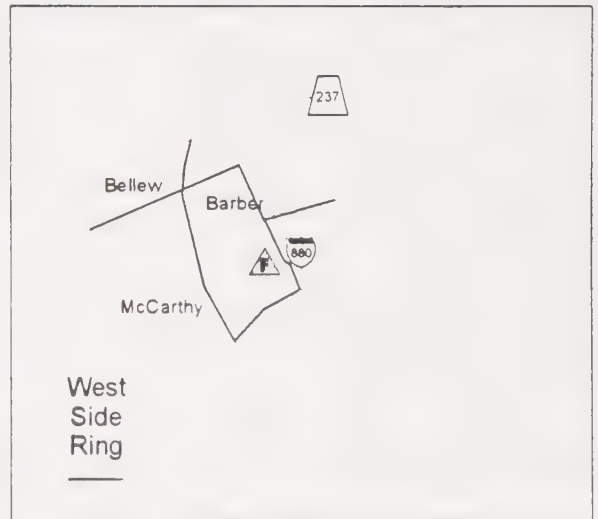


Figure 17

Completion of this phase will also run the City's fiber to the western edge of its jurisdiction where it could be connected to other municipal networks. Interconnected networks could be used to connect the library system, the schools in neighboring jurisdictions and the Emergency Operations Centers of the South Bay communities in case of emergency.

#### *b. The Cost*

MCG estimates that Phase V will cost approximately \$49,104 to complete. The conduit to be used has either already been installed or has already been approved. If new conduit were installed,

MCG estimates that the project would cost at least \$120,912, or \$71,808 more. In reality, the actual cost of installing *new* conduit on the Tasman Bridge, now that it has been completed, cannot be estimated accurately and it is not certain that making such a modification to an existing (and new) bridge would be permitted. This is an excellent example of why the City should install conduit whenever a public works project involves a route that has strategic telecommunications value.

*c. The Timing*

This phase could be completed as soon as the conduit installed during the recycled water project becomes available. However, since it appears that it may be several years before there is significant demand for high volumes of voice and data in this area, the western ring has been scheduled as the last phase of the overall project. If the other phases are completed on schedule, Phase V would be constructed in calendar year 2000.



## SUMMARY OF THE FIBER NETWORK

Figure 18 and Exhibit I depict the fiber ring after the completion of all five phases. As can be seen, the City will have constructed essentially four rings within one large ring. Every major facility operated by the City will be passed by the fiber. Minor facilities (such as pump stations) will be near the fiber cable in almost all cases.

The City will have: interconnected all its major facilities with its own network; achieved independence from the public telephone and cable networks; fixed its network costs for the foreseeable future; and provided a flexible backbone for new services throughout the City. Finally, the City will be poised to interconnect its telecommunications network with networks operated by other governmental entities through the port located on the west side, along Bellevue.

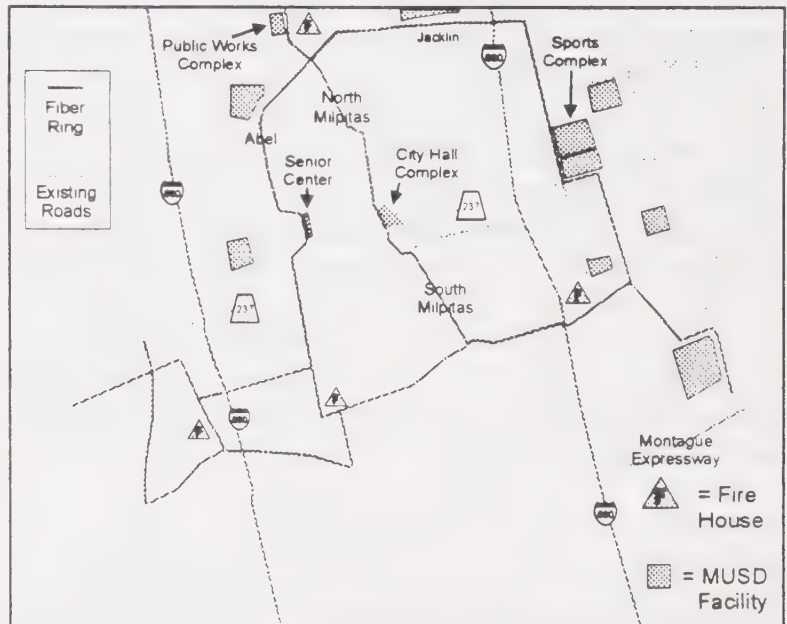


Figure 18

The table below summarizes the cost of each phase of the network (the "net" cost after Centrex savings is not included below):

PHASE	NO. OF FIBER MILES	MINIMUM COST (EXISTING CONDUIT)	MAXIMUM COST (USE OF NEW CONDUIT)
I	1.00	\$70,854	\$111,246
II	3.80	\$108,338	\$265,418
III	3.00	\$103,782	\$205,158
IV	0.75	\$11,682	\$45,342
V	2.00	\$49,104	\$120,912
Total	10.55	\$343,760	\$748,076

The costs listed above include the electronics necessary to distribute voice and data over the network. The cost of internal wiring, terminal equipment and standby power generators (other than at City Hall) are not included.

Exhibit Q shows the estimated present value of the total fiber network costs if an offset against Centrex savings is used to support, in part, the investment. Thus, the cost of new PBX equipment (\$259,777) is added to the network totals in the first year. Thereafter, it is assumed that 5.0% of the PBX cost (increased for inflation) is expended each year for maintenance.

It is assumed that each subsequent phase of the network is constructed over one year and the estimated Centrex savings are realized over the ten year life of the phone system. The network investment and the Centrex savings are brought to present value and then subtracted to estimate the "real" cost of the network investment over the estimated life of the network.

The spreadsheet shows that if existing conduit is used to construct the extended fiber ring through Phase V, the "net" cost to the City of the ring will be \$192,692. If the City cannot use the existing traffic control conduit and must install new conduit for those portions of the network, the "net" cost will be \$285,042.

MCG recommends that the City plan to build the entire fiber ring -- all five phases. The ring should be viewed like any other essential City infrastructure, water, sewer, streets, etc. Moreover, MCG believes the City should be vigilant and whenever the opportunity arises to extend the network to new locations which logically should be connected, it should seize the opportunity, install conduit and fiber, and extend the reach of its network.

However, MCG realizes that the realities of municipal financing may well impact the City's ability to match its financial resources with its telecommunication goals. If the City feels that the entire project is too costly, MCG recommends that the City complete Phases I - III. This will establish a self-healing fiber ring which passes every major City facility and will permit the City to use its network nearly to its potential.



## E. CONTROL OVER RIGHTS OF WAY

The final recommendation pertains to the City's control over its rights of way. For the reasons discussed below, MCG is of the opinion that the City should exercise greater control over the way that telecommunication providers and other utilities use the streets and by-ways in Milpitas.<sup>30</sup>

As discussed in Section VII, *supra*, the City streets are about to be cut by Pacific Bell and by a number of competitive access providers for the purpose of laying fiber and, in the case of PacBell, coaxial cable as well. Each of these companies will seek to provide telephone service to the businesses located within the City and, thus, will undoubtedly follow the same basic fiber routes through the business areas of the City.<sup>31</sup> Moreover, the CAP's will race to connect the largest long distance users in the City to their networks in order to capture the large revenue streams generated by those companies. PacBell will try to protect its existing service to those customers by upgrading its plant, if necessary. Thus, it is likely that the City's major thoroughfares will be torn up over and over again as each CAP and PacBell installs fiber cable.

The City of San Francisco commissioned a study on the effect of street cuts on the predicted life of asphalt and concrete streets. The final report, which was issued in May, 1995, is attached hereto as Exhibit R. The table below summarizes the conclusions of the report.

Asphalt Streets With:	Useful Life
Less than 3 cuts	26 Years
Between 3 and 9 cuts	18 Years
More than 9 cuts	13 Years

Thus, if a street is cut three or more times, its expected useful life could be reduced by up to 31%. If it is cut more than nine times, its useful life could be reduced by 50%.

If MFS, TCG and PacBell each trench down Main Street, Jacklin, Abel or Milpitas Boulevard, as is likely, the useful life of the surface of these very busy streets could be reduced by 31%, or eight years. If telecommunications competition becomes intense, it is possible that these companies may be joined by AT&T, MCI, Sprint, the local cable company and others. The impact of this damage

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<sup>30</sup> There is telecommunications legislation pending in Congress (H.R. 1555 and S. 652) which may impact the discussion in this section. However, at the time of submission, the House and Senate bills were in conference committee and a final bill had not been reported.

<sup>31</sup> Pacific Bell and some of the CAP's will also be interested in providing telephone service to the residential areas of the City. Indeed, both MFS and TCG have applied for co-carrier status in California under the CPUC's new guidelines. However, for purposes of the instant discussion, the focus will be on the business market because service to businesses will involve construction along the most heavily traveled streets in the City.



to the streets will have a significant impact on City resources at a time when the City's ability to garner revenue has been diminished by law and public attitude.

As important, the intersection of Calaveras and Milpitas Boulevard has a poor level of service rating due to a significant amount of traffic. Repeated construction down these major traffic routes would be extremely disruptive to traffic and to businesses located along the rights of way. The City would have to expend significant resources for police and public works employees to handle the construction and the traffic disruption. The short term impact of multiple street cuts will be significant on both the public and the private sector.

In addition, if the City adopts the fiber network plan proposed herein, it will install its own telecommunications network along portions of the routes most likely to be used by the CAP's and PacBell. This network will carry a significant volume of information, some of which will have material importance to the health, safety and welfare of the citizens of Milpitas. It is imperative that the City take all steps prudent to protect the physical integrity of its network. Exhibit S contains a typical cross-section of a city street. As the drawing makes clear, the streets already contain a significant amount of infrastructure packed into a limited volume.<sup>32</sup> Encouraging telecommunications providers to share underground facilities whenever possible and to excavate and locate very carefully when sharing is not possible must be a high priority for the City.

Therefore, MCG recommends that the City adopt a comprehensive policy governing the use of its streets and by-ways. Specifically, MCG recommends that the City consider adopting the following policies:

1. Telecommunications companies should be required, if possible, to lease conduit space from the City whenever the City has excess capacity, subject, of course to agreeing upon the appropriate rent and terms.
2. In cases where the telecommunications company will not or cannot share existing conduit and is issued a permit to bury its own conduit and cable, the City should require the company to reimburse the City for the necessary and reasonable costs of City services expended as a result of the construction. This should be paid in advance before the permit is issued, if the costs can be ascertained with reasonable accuracy.
3. The City should undertake to determine the net present value of the average damage caused by each excavation of a City street and assess that sum to any applicant applying for permission to open a major street. The City could use the San Francisco study as the basis for its calculations, or it could undertake its own study.

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<sup>32</sup> Exhibit S shows why true "route diversity" is usually a myth in an urban environment. Telecommunication providers generally follow the same routes to reach the same customers in the business areas of a city and, therefore, even if they each use their own conduit, the extent of their diversity is measured in feet below the same streets.



Recovering the present value of the repair costs of the street cut will protect the citizens of Milpitas from bearing the financial burden of repairing the damage caused by private companies seeking to use the City's resources to make a profit for their owners or shareholders.

4. In lieu of the fee discussed in Item 3, above, the City could request that a company installing conduit beneath the streets install additional ducts whenever practical, particularly along major roads. As a permitting condition, the City could require the company that is "first in" under this approach agree to lease unused ducts to subsequent users at reasonable market rates (subject to arbitration in case of a failure to agree on market value).

5. In all cases, require that companies trenching or boring the streets place their conduit or cable precisely where the City specifies. This will limit the possibility of a fiber cut to the City's own network and to the fiber cable of other companies. It will also minimize the need for larger excavations to access and repair cut cables. If a company fails to follow the placement specified by the City and damages the City's facilities, permits should be canceled until restitution is made and the City facilities are restored.

6. Finally, the City should consider adopting a "moratorium" on street excavations following a street cut. Many cities, including San Francisco, do this. San Francisco has a two year policy. MCG has contacted municipalities with five year policies.

MCG recognizes that some of these recommendations may be perceived as innovative, however, the new networks being installed by the cable television companies, the public telephone companies and the competitive access providers are full service networks designed to deliver telephone, data and video entertainment services to every customer. Since some of these activities clearly do not fall within the definition of traditional utility services, it seems logical that the City should regulate these networks to the extent reasonable to protect the health, safety and welfare of its citizens under its police powers.

MCG is mindful that federal legislation is currently pending in Congress which may affect the City's ability to adopt all the proposals set forth above. Moreover, there are unresolved legal and policy questions concerning the application of traditional public utility regulation over networks which will deliver regulated and unregulated services and the resolution of these questions may affect the City's ability to act as well. Nevertheless, MCG believes it is incumbent upon the City to study these matters so that it is prepared to go forward in a prudent manner as quickly as possible.

## X. CONCLUSIONS

Much has been written about the decade of the 90's being the "information age." Whether this proves to be true or not, the City of Milpitas clearly faces an exponential growth in the amount of information that it must process in order to provide municipal services to its citizens. Moreover, the City's revenue base will not grow as quickly as the demand for volume and sophistication of services grow. Investing in the new telecommunications technologies discussed herein will assist the City in handling the expanding demand for services with less additional staff. The new technologies will also assist the City in containing operating expenses.

By planning carefully, the City of Milpitas can develop a very sophisticated telecommunications infrastructure in a most cost-effective manner by using existing resources and by using future public works projects to expand the network. If the City is disciplined in its overall approach and if it integrates its planning functions to maximize the opportunities for cost savings, it will own and operate one of the most sophisticated telecommunication networks in the country.